A330
TECHNICAL TRAINING MANUAL
MECHANICAL & AVIONICS COURSE - T1+T2 (LVL 2&3)
(RR Trent 700)
FUEL (Metric Units)

This document must be used for training purposes only

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FUEL (METRIC UNITS)

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G9409341 - GAUT0T0

FUEL LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW

The fuel system has different functions, which are:
- storage, venting and scavenge,
- engine feed,
- APU feed,
- main and trim transfers,
- refuel/defuel,
- jettison as an option,
- and the maintenance/test facilities.

A330-200 OVERVIEW

The fuel is stored in six tanks. In each wing, there is an outer tank, and an inner tank divided into two parts: the forward inner tank, and the aft inner tank. There is also a center tank, and a trim tank. Each inner tank section has one closed area called the collector cell, which is a reservoir for the booster pumps. A dedicated jet pump is only used to fill the collector cell of the main booster pumps. A vent surge tank is installed outboard of each outer tank in the wing and on the RH side of the trim tank. They vent the fuel tanks and collect fuel split from the tanks. Each tank has one or more water drain valves located at low points.

Engine Feed:

An independent fuel feed system supplies each engine. For each engine, there are two main fuel pumps, and one stand-by pump. In the normal configuration the main pumps are running and the stand-by pump is there as a back up when a main pump has a too low output pressure. A LP valve isolates its related engine from the fuel supply. The crossfeed system enables any engine to be fed from any tank. It is used to correct fuel imbalance between tanks or during gravity feeding of the engines.

APU Feed:

Fuel is supplied to the APU from the LH inner tank collector cell with the forward APU pump through the trim transfer line. If a low pressure is detected in the trim transfer line, the aft APU pump stars. The APU fuel isolation valve controls the fuel flow from the FWD inner tank to the trim transfer line. If an APU fire is detected, the APU LP valve closes. The fuel/air separator, installed in the trim tank fuel transfer line, keeps sufficient fuel for APU operation if air enters the transfer line.

Main Transfer:

The main transfer system controls the fuel flow from the center tank and the outer tanks to the two inner tanks for engine feeding. The two transfers are usually controlled automatically by the Fuel Control & Monitoring Computers (FCMCs), but they can be manually controlled if necessary. The trim transfer system controls the A/C center of gravity by forward and aft transfers. Trim transfers are controlled automatically by the FCMCs, but a manual forward transfer can be initiated from the fuel panel if a failure occurs.

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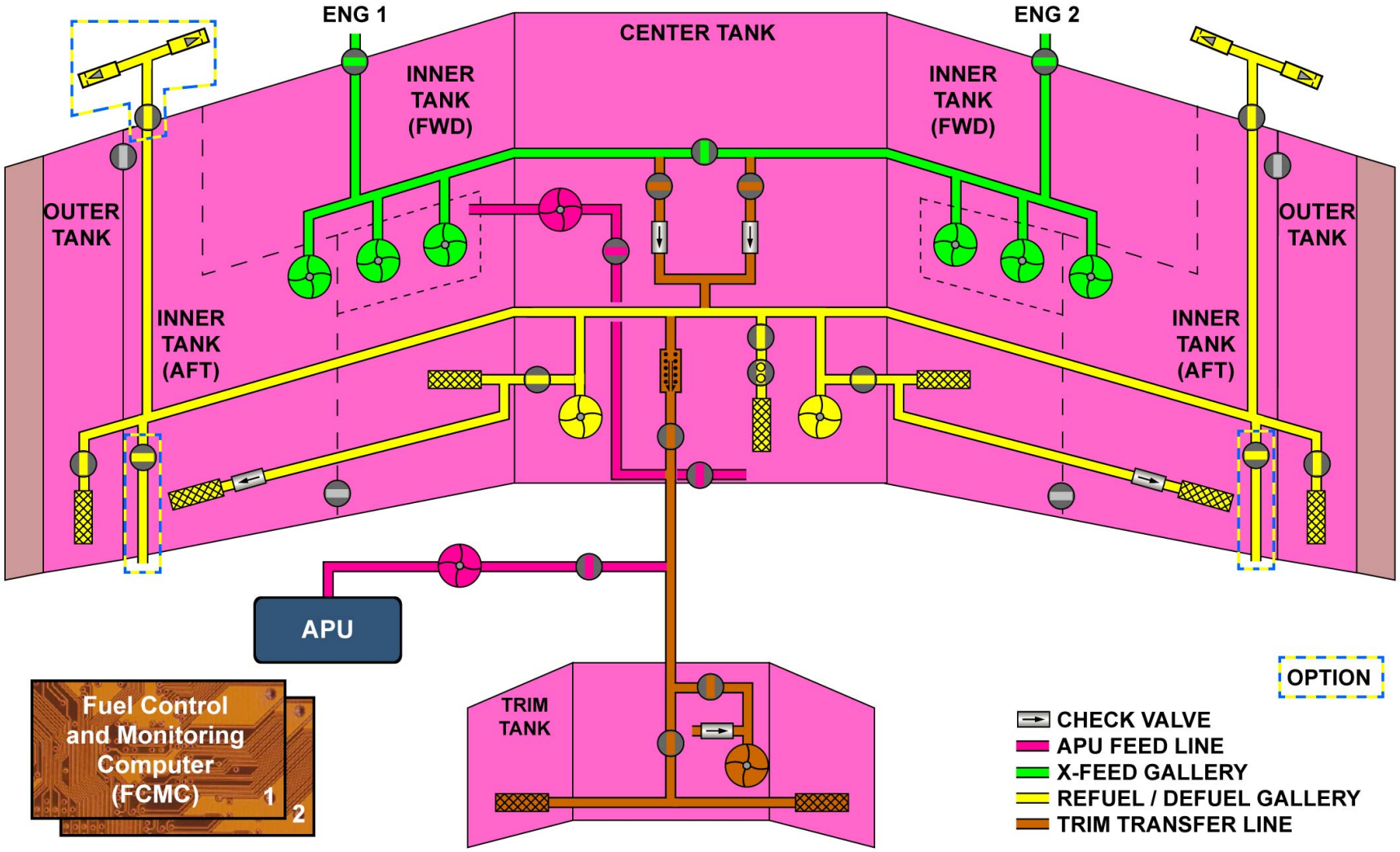

SYSTEM OVERVIEW - A330-200 OVERVIEW

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FUEL LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

A330-300 OVERVIEW

The fuel is stored in five tanks. In each wing, there is an outer tank, and an inner tank divided into two parts: the forward inner tank, and the aft inner tank. There is also a trim tank. Each inner tank section has one closed area called the collector cell, which is a reservoir for the booster pumps. A dedicated jet pump is only used to fill the collector cell of the main booster pumps. A vent surge tank is installed outboard of each outer tank in the wing and on the RH side of the trim tank. They vent the fuel tanks and collect fuel split from the tanks. Each tank has one or more water drain valves located at low points.

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Fuel is supplied to the APU from the LH inner tank collector cell with the forward APU pump through the trim transfer line. If a low pressure is detected in the trim transfer line, the aft APU pump starts. The APU fuel isolation valve controls the fuel flow from the FWD inner tank to the trim transfer line. If an APU fire is detected, the APU LP valve closes. The fuel/air separator, installed in the trim tank fuel transfer line, keeps sufficient fuel for APU operation if air enters the transfer line.

Main Transfer:

The main transfer system controls the fuel flow from the outer tanks to the two inner tanks for engine feeding. The FCMCs usually control automatically the transfers, but they can be manually controlled if necessary. The trim transfer system controls the A/C center of gravity by forward and aft transfers. The FCMCs automatically control trim transfers, but a manual forward transfer can be initiated from the fuel panel if a failure occurs.

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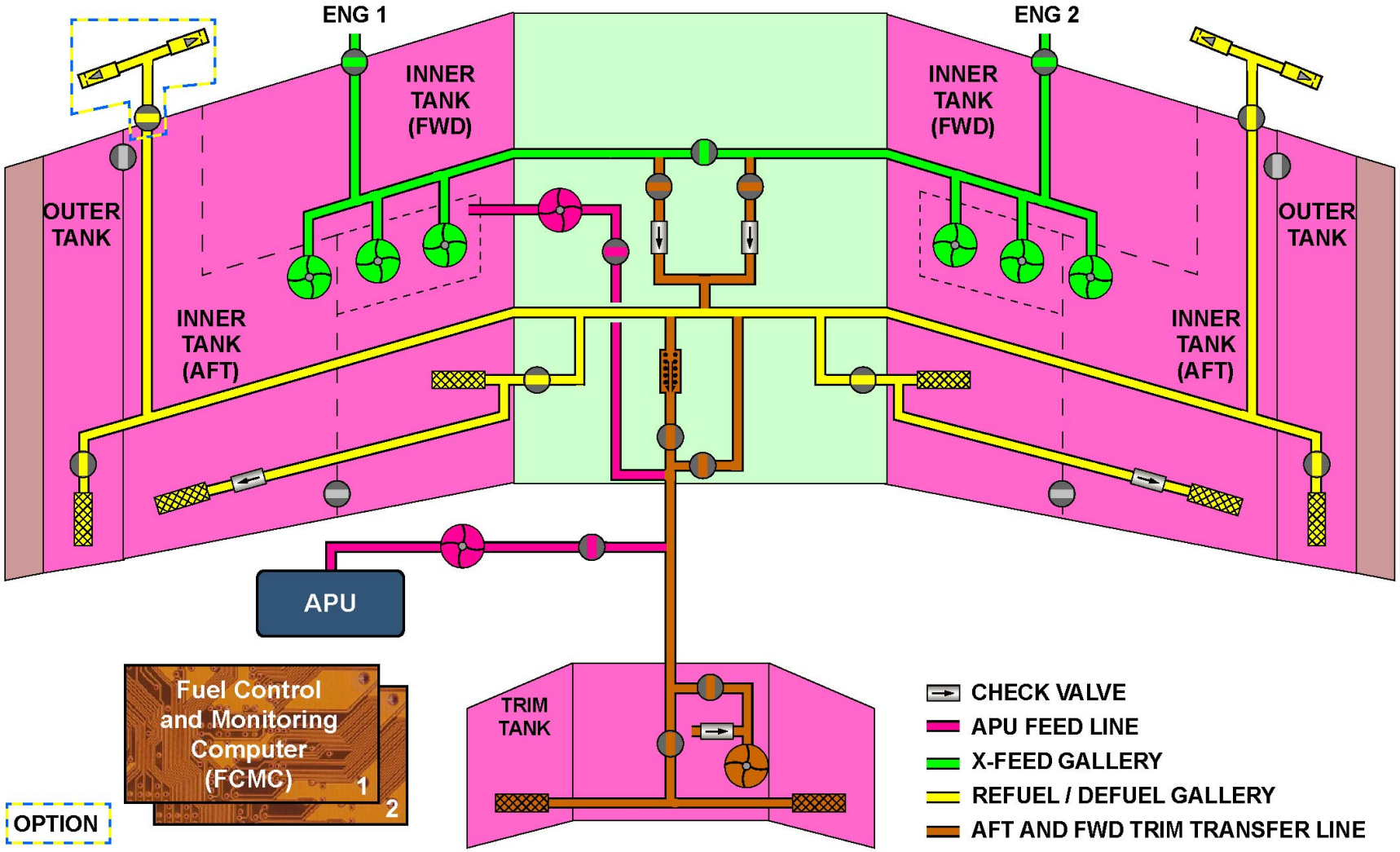

SYSTEM OVERVIEW - A330-300 OVERVIEW

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FUEL LINE MAINTENANCE BRIEFING (2)

SERVICING

Automatic refueling may be accomplished with normal electrical power established or with battery power only.

NOTE: On battery power only, the ADIRS does not send attitude information to the FCMS, so there could be a difference up to 750kg. between the PRESELECTED and ACTUAL fuel quantity after refueling.

Procedure:
- set parking brake,
- put chocks in position. Make sure that the chocks do not touch the tires. The additional fuel weight can cause the tires to contact the chocks,
- connect 2 or 4 hoses to the fuel couplings,
- put ADIRU 1, 2, 3 in NAV position on the overhead panel,
- open the Refuel panel access door on the lower fuselage,
- if necessary, set the PoWeR SUPPLY to BATtery,
- do the hi level test - hi-level & overflow lights change condition, CocKPiT & END lights come on, fuel quantity, preselected & actual displays show all 8's,
- operate the load switch to INC to set the preselected value to the total fuel quantity required,
- check refuel valve switches are in norm and guarded position,
- set the mode select switch to REFUEL - make sure that the fuel quantity and ACTUAL values increase,
- the end light comes on steady when refueling is complete - The actual and preselected values agree within ± 200 kg.

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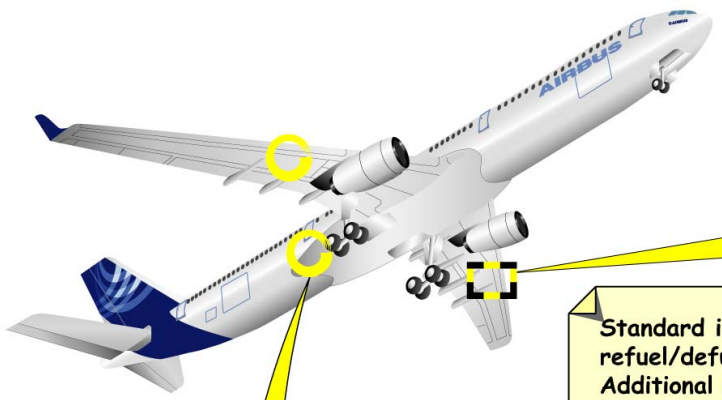
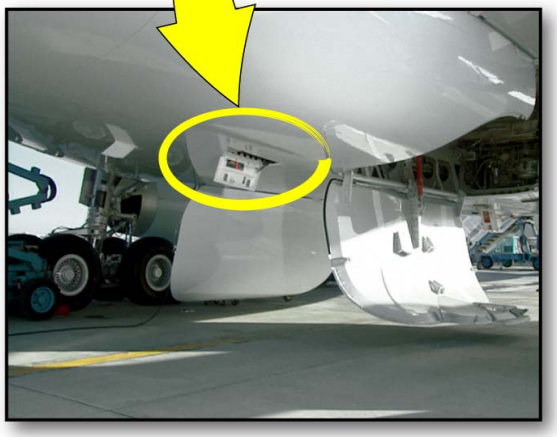


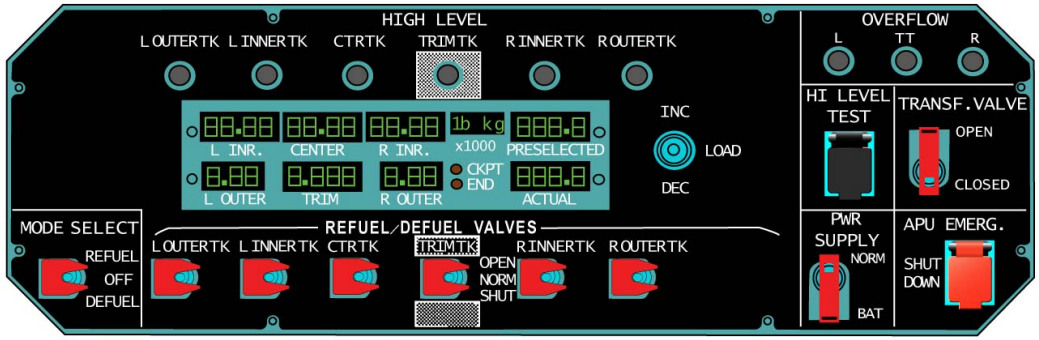
Standard installation is refuel/defuel coupling on right wing. Additional coupling on left wing is optional on A330-300 only.

REFUEL COUPLING

As an option, the refuel/defuel panel may be located at the wing leading edge.



OPTIONAL REFUEL PANEL LOCATION



REFUEL/DEFUEL PANEL (990VU)

SERVICING

FUEL LINE MAINTENANCE BRIEFING (2)

DAILY CHECKS

Years of operational experience have shown that regular draining of the fuel tank water content will prevent many fuel system problems. The Maintenance Planning Document (MPD) recommends that operators do this procedure every 7 days or less.

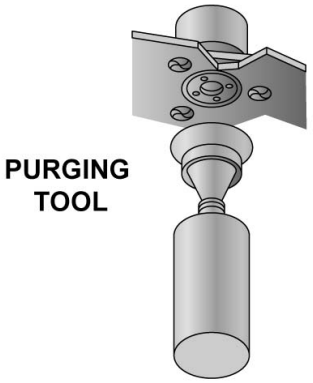
DRAIN WATER CONTENT

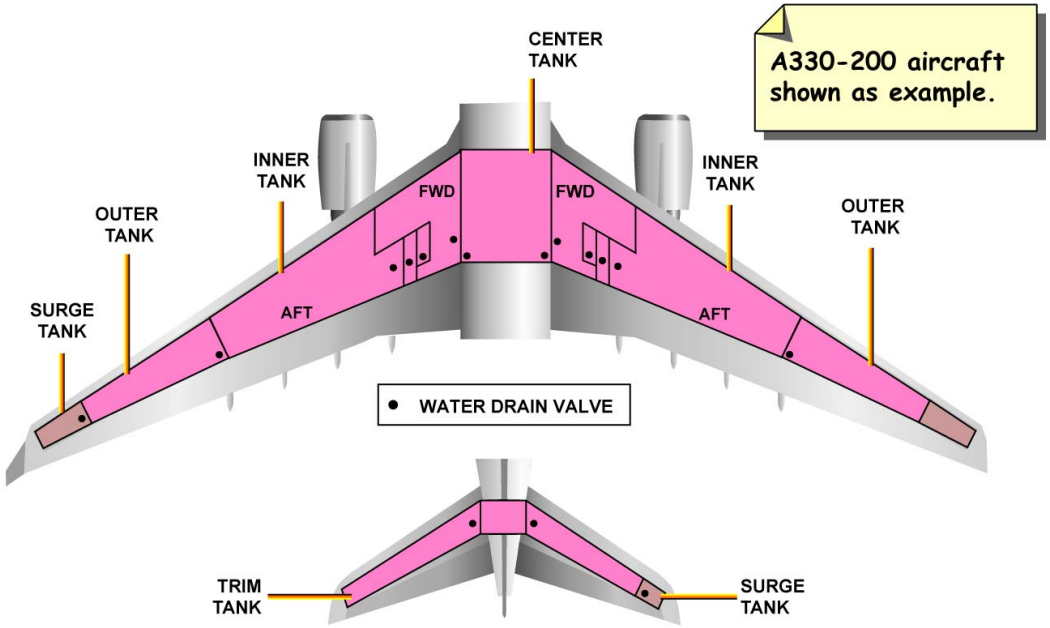
The water drain valves are installed in the center tank, in the wing, and in trim tanks. All drains should be operated to carry out proper water removal from the fuel. There are 2 drains in the center tank, 7 in each wing, and 3 in the trim tank.
If possible, the best time to drain the water from the tanks is prior to the refueling. If that is not possible, wait one hour after refueling for the fuel to stabilize. The center tank drain valves are found in an access panel on either side of the fuselage. The wing drain valves are accessible from the underside of the wing. For gravity purging, the center and wing tanks need > 10% tank content and the trim tank needs at least 1,000 kg (2200 lb). The THS should also be moved to 0° trim. To operate the drain valves, use the PURGER tool and push up on the valve. Make sure to drain at least one liter of fuel for proper water removal. When draining is complete, remove the PURGER tool and make sure that there is no leakage at the drain valve. If the drain valve leaks, set correctly the valve by pushing up and releasing the drain valve again.

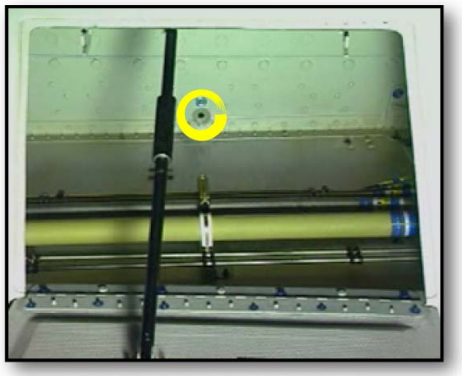
ENVIRONMENTAL PRECAUTIONS

Do not discharge products such as oil, fuel, solvent, lubricant either in trash bins, soil or into the water network (drains, gutters, rain water, waste water, etc...).
Sort waste fluids and use specific waste disposal containers.
Each product must be stored in an appropriate and specific cabinet or room such as a fire-resistant and sealed cupboard.

This is the water drain valve operation video.







CENTER TANK DRAIN
VALVE ACCESS

TYPICAL WING WATER
DRAIN VALVE

TYPICAL WATER
DRAIN VALVE

DAILY CHECKS - DRAIN WATER CONTENT & ENVIRONMENTAL PRECAUTIONS

FUEL LINE MAINTENANCE BRIEFING (2)

MEL/DEACTIVATION

CROSSFEED VALVE FAILURE

In case of a crossfeed valve failure, and if we are not in Extended Range operations the aircraft may be dispatched referring to the MEL with valve inoperative in the CLOSED position. In addition, the inner and outer tank inlet valves, all fuel quantity indications and both center tank transfer pumps (A330-200) must be operational. The cross feed valve is deactivated by removing the actuator and installing a locking tool.

WARNING: Obey all safety procedures related to flight controls, landing gear and the fuel system when following this procedure

Procedure:

- on the ECAM FUEL page, check that the crossfeed valve is in the green/crossline position (closed),
- open XFEED VaLVe MOTor C/B's,
- do an operational test of the outer and inner tank inlet valves from the MCDU/FCMC Fuel Valves Test menu,
- (A330-200 only) do an operational test of the center tank transfer pumps. Transfer fuel from the center tank using each pump independently,
- at the applicable valve, check the OPEN/CLOSED indicator and remove the actuator,
- if the valve was open, use an applicable tool to fully close the valve,
- install DUMMY plug and receptacle on the connectors removed from the actuator,
- align dowel and install the valve locking tool. Secure with the v-band clamp.

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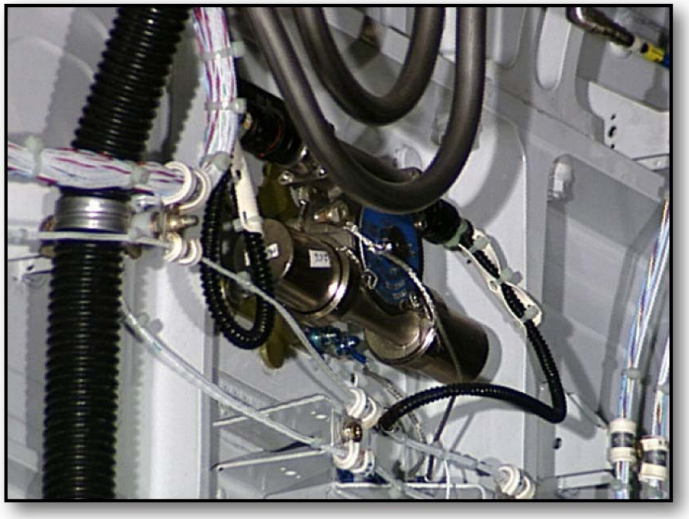
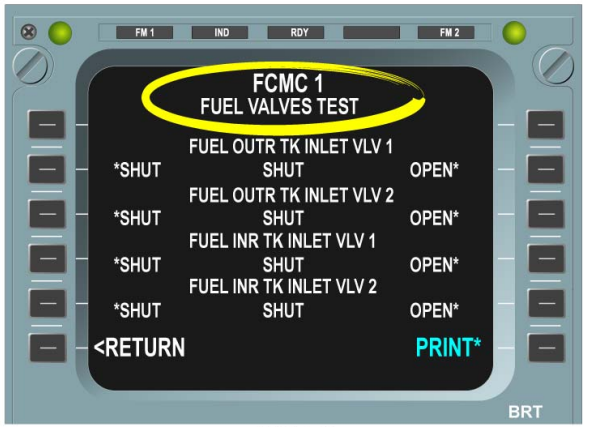
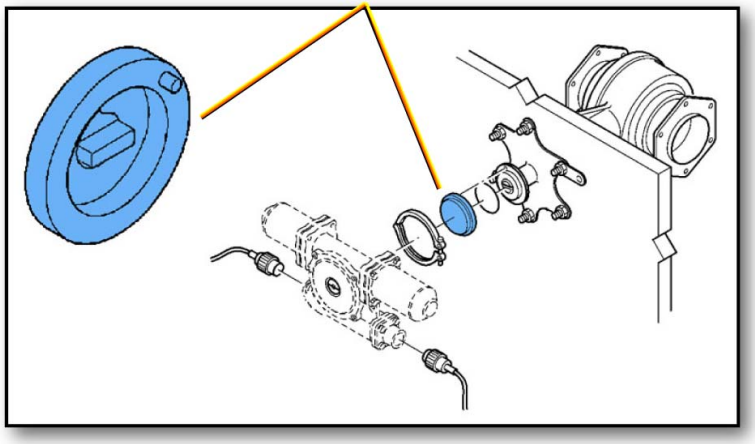
CROSSFEED VALVE





MCDU

VALVE LOCKING TOOL



	28-23 CROSSFEED SYSTEM					
R R R R R R R R R R R R	23-01 Crossfeed Valve	B	1	0	*(o)(m)	Except for ER operations, may be inoperative in closed position provided: 1) Both outer tank inlet valves are operative, and 2) Both inner tank inlet valves are operative, and 3) All fuel quantity indications are operative on ECAM FUEL page, and 4) Both center tank transfer pumps are operative when there is fuel in center tank.

MEL

MEL/DEACTIVATION - CROSSFEED VALVE FAILURE

FUEL LINE MAINTENANCE BRIEFING (2)

MEL/DEACTIVATION (continued)

REFUEL ISOLATION VALVE FAILURE

During refueling, the refuel isolation valve solenoid is energized and fuel pressure from the tanker/pump unit opens the valve. If the solenoid fails or if the electrical control of the solenoid fails, the valve may be operated by a manual plunger. To refuel the aircraft, PUSH and HOLD the plunger on the valve. The fuel pressure from the tanker/pump unit will open the valve. Be sure to monitor the fuel quantity carefully using the normal indication system. When the desired quantity is reached, release the plunger to close the valve.

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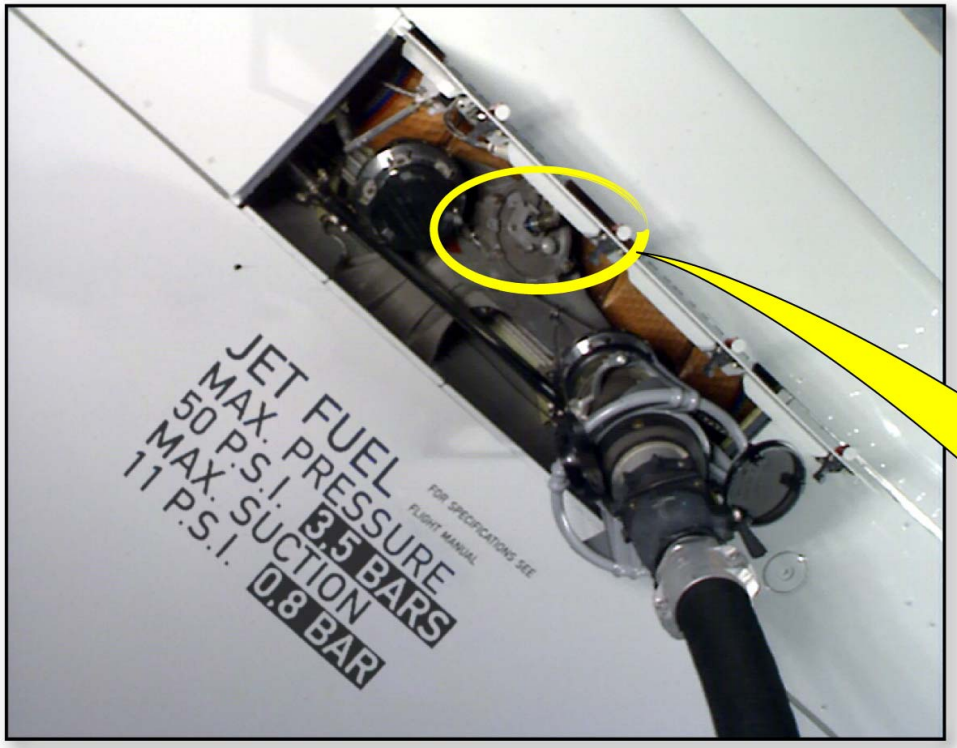
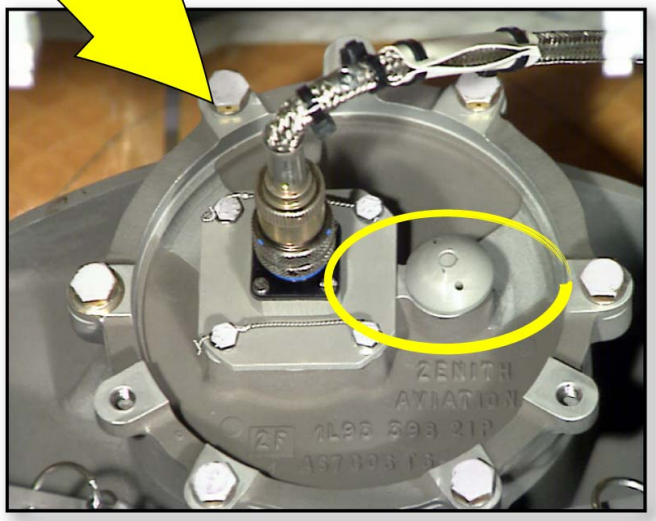


REFUEL COUPLING



REFUEL ISOLATION VALVE

MEL/DEACTIVATION - REFUEL ISOLATION VALVE FAILURE

FUEL LINE MAINTENANCE BRIEFING (2)

MEL/DEACTIVATION (continued)

FUEL QUANTITY INDICATION FAILURE

The aircraft may be dispatched with unserviceable fuel quantity indications. One OUTER, one INNER, or the CENTER tank quantity indication may be inop as per the MEL. The TRIM tank indication may be inop as long as there is no fuel in the TRIM tank.

NOTE: An indication with dashes on the two last digits is considered operative. The loss of accuracy must be taken into account for fuel planning.

The conditions for dispatch with an OUTER quantity inop are:
- after refueling, check fuel quantity in the related tank using the manual MLIs,
- the FUEL used indication must be operational,
- adjacent INNER tank fuel quantity is operational,
- low Level sensing system test OK (check on MCDU/FCMC menu).

The conditions for dispatch with an INNER quantity inop are:
- after refueling, check fuel quantity in the related tank using the manual MLIs,
- the FUEL used indication must be operational,
- left and right INTERTANK valves are closed (check on MCDU/FCMC menu),
- low Level sensing system test OK (check on MCDU/FCMC menu).

The conditions for dispatch with a CENTER quantity inop are:
- after refueling, check fuel quantity in the related tank using the manual MLIs,
- the FUEL used indication must be operational,
- all INNER and OUTER tank fuel quantities are operational.

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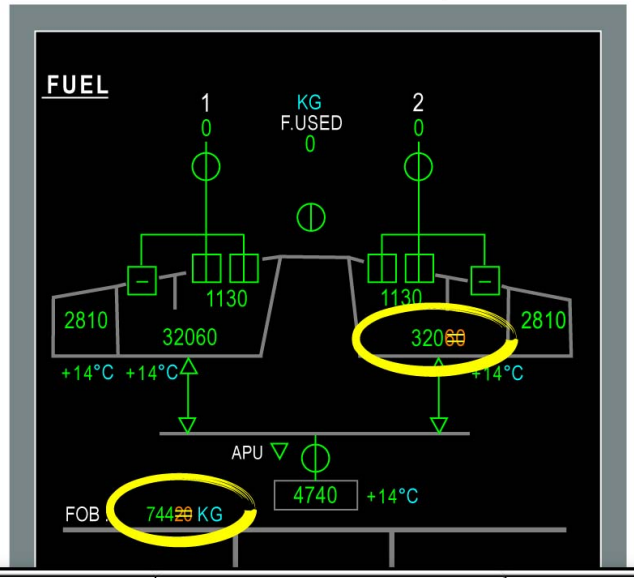
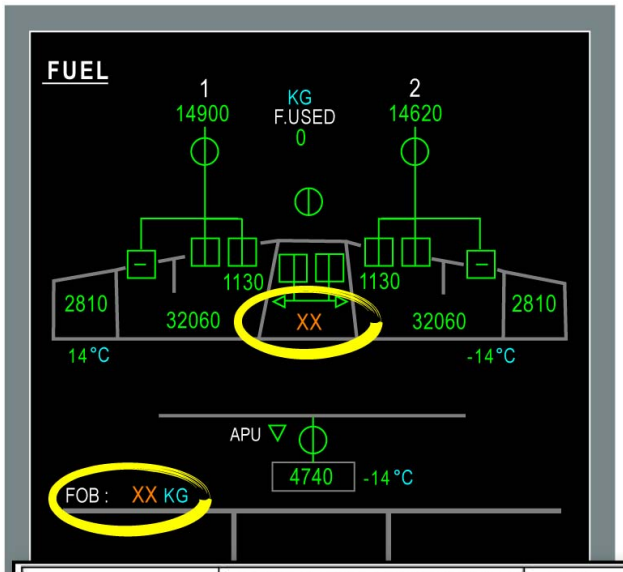
A330-300 RIGHT INNER "DASHED" (SERVICEABLE)



	MASTER MINIMUM EQUIPMENT LIST	01-28	P 18
	FUEL	SEQ 001	REV 17

1. SYSTEM AND SEQUENCE NUMBERS / ITEM	2. RECTIFICATION INTERVAL	3. NUMBER INSTALLED	4. NUMBER REQUIRED FOR DISPATCH	5. REMARKS OR EXCEPTIONS
28-42 QUANTITY INDICATING 42-01 Indication on ECAM FUEL Page				*NOTE* *An indication with dashes on the two last digits is considered operative. The loss of accuracy must be taken into account for the fuel planning (see associated operational procedure in section 02).*

A330-200 CENTER TANK INDICATION INOP



	MASTER MINIMUM EQUIPMENT LIST	01-28	P 19
	FUEL	SEQ 001	REV 17

1. SYSTEM AND SEQUENCE NUMBERS / ITEM	2. RECTIFICATION INTERVAL	3. NUMBER INSTALLED	4. NUMBER REQUIRED FOR DISPATCH	5. REMARKS OR EXCEPTIONS
C) Center	C	1	0	*(o)(m) May be inoperative provided : 1) Fuel quantity is checked after each refueling by manual magnetic indicators, and 2) All wing tanks fuel quantity indications are operative on ECAM FUEL page, and 3) All F. USED indications are operative on ECAM FUEL page, and 4) Manual forward transfer from trim tank to center tank is carried out as soon as possible after takeoff when positive pitch angle is less than 3 degrees.

MEL/DEACTIVATION - FUEL QUANTITY INDICATION FAILURE

G9409341 - GAUT0T0 - FM28B1000000003

FUEL LINE MAINTENANCE BRIEFING (2)

MEL/DEACTIVATION (continued)

USE OF MAGNETIC LEVEL INDICATORS (MLIs)

Each fuel tank has one or more MLIs. In case of an indication malfunction, the MLIs may be used to check fuel quantity. There is one MLI in the CenTeR tank (A330-200 only), 4 in each INNER tank and 2 in each OUTER tank.
The aircraft attitude will determine which fuel table to use. The Air Data Inertial Reference Unit (ADIRU) will be used to find the aircraft attitude. The air data inputs to the ADIRU can be read by using the alpha call-up function in the Aircraft Condition Monitoring System (ACMS). With the ADIRU's in the NAV position, select the ACMS menu in the Central Maintenance System (CMS). From this menu, select CALL UP PARAM ALPHA. Type ROLL to access roll data and type PTCH to access pitch data.
To use the MLI, extend the indicator rod and read the UNITS mark nearest the bottom surface of the wing. Each tank is separately checked. To determine wing volume, use the most outboard MLI, which indicates fuel in the tank. To check the total fuel quantity on the aircraft determine the total in each tank (CTR, INNER, OUTER) and add them together.

NOTE: A small correction for the COLLECTOR cells may be applied to the INNER tank volume based on the time since the boost pumps were shut off.

Using the attitude reference + MLI number + MLI reading, find the correct fuel table in the AMM and read the fuel volume. The MLI No identifies the tables. Make sure to identify LEFT or RIGHT MLI on the table to avoid miscalculations. The final step is to convert the volume to weight. Multiply the volume by the fuel specific gravity.

NOTE: The fuel specific gravity reading may be from a fuel sample or from the FCMS INPUT PARAMETERS (MCDU/FCMC menu)

For example:
RIGHT wing MLI number - 6
Attitude: P= -1,0, R= 0,5
UNITS reading - 10
Volume in liters - 720
Sp. Gravity - 0.81
Fuel weight = 583 Kg.

NOTE: Only even-numbered MLI units are listed in the tables. To calculate the volume of fuel for odd numbers, interpolate (divide the difference) between the nearest even numbers in the table.

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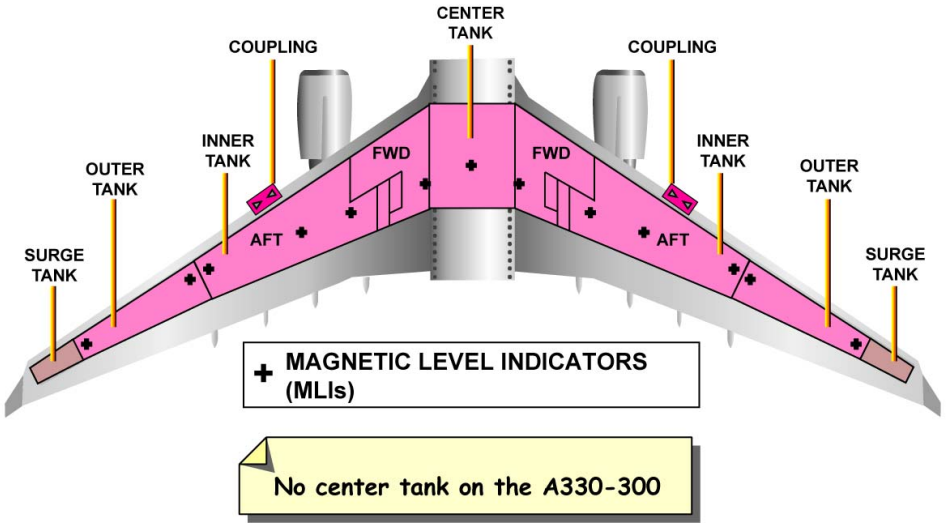
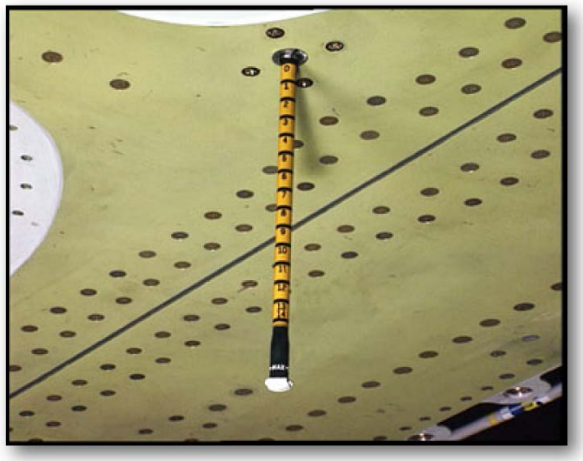
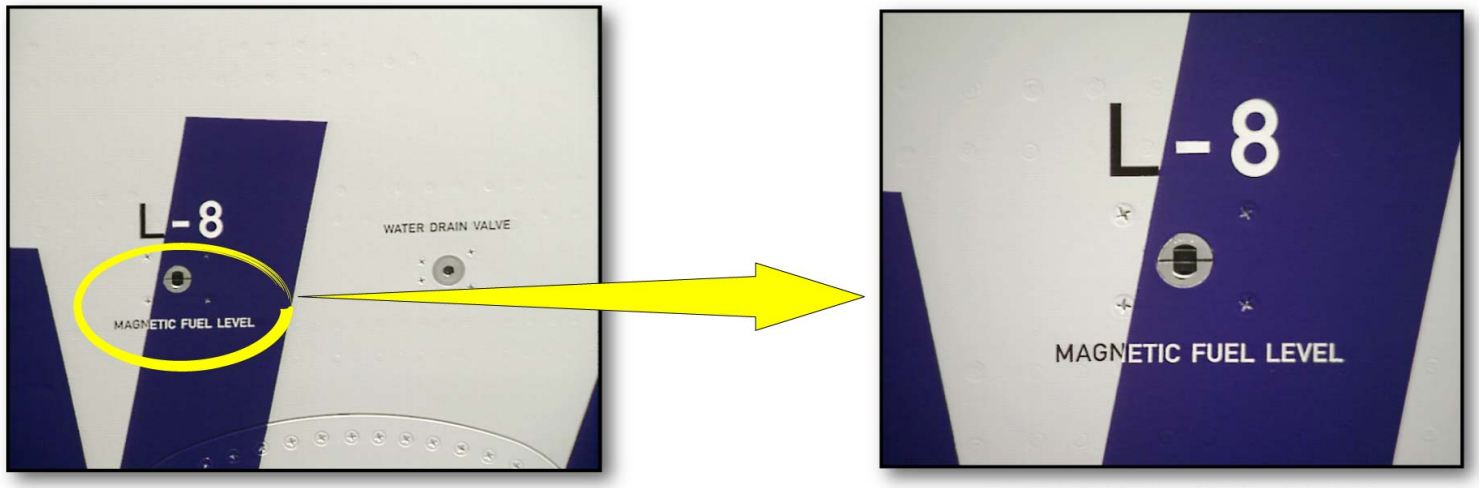


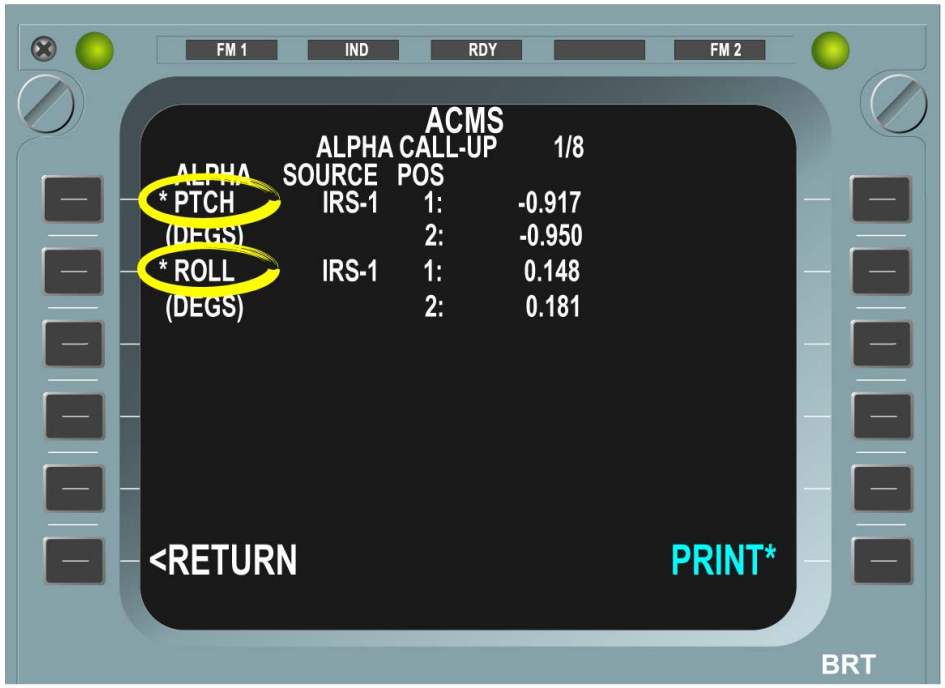


MLI EXTENDED



MLI RETRACTED AND LOCKED

MEL/DEACTIVATION - USE OF MAGNETIC LEVEL INDICATORS (MLIS)



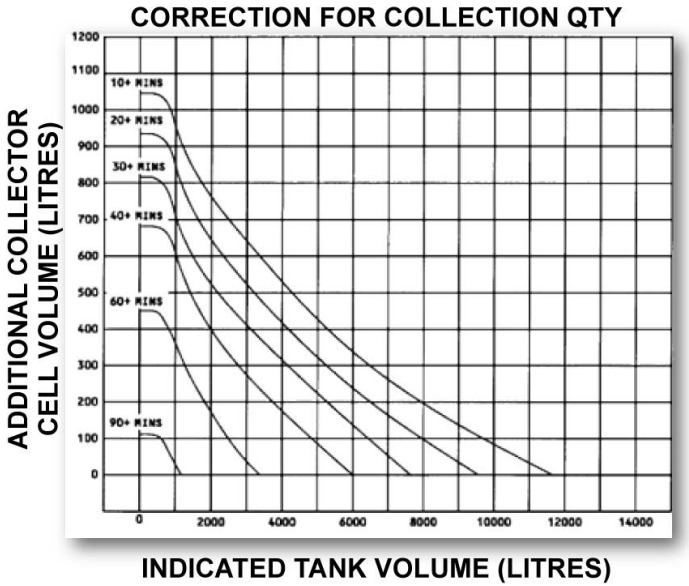
AIRCRAFT ATTITUDE

MEL/DEACTIVATION - USE OF MAGNETIC LEVEL INDICATORS (MLIS)

G9409341 - GAUT0T0 - FM28B1000000003

MLI No. 6

ADJRS P	ADJRS R	STICK HEIGHT 0	2	4	6	8	10	12	14	16	18
		LITERS									
-2.5	-1.5	290	370	450	550	660	770	900	1030	1180	1330
-2.5	-1.0	290	370	450	540	640	750	870	990	1120	1270
-2.5	-0.5	300	370	450	540	630	740	840	960	1080	1220
-2.5	0.0	310	380	460	540	630	730	830	940	1060	1180
-2.5	0.5	320	380	460	540	630	720	820	930	1040	1150
-2.5	1.0	330	400	470	550	630	720	810	920	1020	1130
-2.5	1.5	340	410	480	550	630	720	810	910	1010	1120
-2.0	1.5	330	400	470	550	630	720	810	910	1010	1120
-2.0	1.0	320	390	460	540	630	720	810	920	1030	1140
-2.0	0.5	310	380	460	540	630	720	820	930	1040	1160
-2.0	0.0	300	370	450	540	630	730	830	950	1070	1200
-2.0	-0.5	290	370	450	540	630	740	850	970	1100	1240
-2.0	-1.0	290	360	450	540	640	760	880	1010	1150	1290
-2.0	-1.5	280	360	450	550	660	780	910	1050	1210	1370
-1.5	-1.5	270	350	450	550	670	800	930	1080	1240	1410
-1.5	-1.0	280	360	440	540	650	780	890	1030	1170	1320
-1.5	-0.5	290	360	440	530	630	740	860	980	1120	1260
-1.5	0.0	290	370	450	530	630	730	840	960	1080	1210
-1.5	0.5	300	370	450	530	620	720	820	930	1050	1180
-1.5	1.0	310	380	460	540	620	720	820	920	1030	1150
-1.5	1.5	320	390	460	540	630	710	810	910	1020	1130
-1.0	1.5	320	380	460	540	620	710	810	910	1020	1140
-1.0	1.0	310	370	450	530	620	720	820	920	1040	1160
-1.0	0.5	300	370	440	530	620	720	830	940	1060	1190
-1.0	0.0	290	360	440	530	630	730	840	970	1100	1230
-1.0	-0.5	280	350	440	530	640	750	870	1000	1140	1290
-1.0	-1.0	270	350	440	540	650	770	910	1050	1200	1360
-1.0	-1.5	260	350	450	550	660	810	960	1120	1280	1470
-0.5	-1.5	260	350	450	560	690	840	980	1160	1340	1530
-0.5	-1.0	260	350	440	540	660	790	930	1080	1240	1410
-0.5	-0.5	270	350	440	530	640	760	880	1020	1170	1320
-0.5	0.0	280	350	440	530	630	740	850	980	1110	1260
-0.5	0.5	290	360	440	530	620	720	830	950	1060	1210
-0.5	1.0	300	370	450	530	620	720	820	930	1050	1170
-0.5	1.5	310	380	450	530	620	710	810	920	1030	1150
0.0	1.5	300	370	450	530	620	710	810	920	1040	1160
0.0	1.0	290	360	440	530	620	720	820	940	1060	1190
0.0	0.5	280	350	440	530	620	730	840	960	1090	1230
0.0	0.0	270	350	430	530	630	740	860	1000	1140	1290
0.0	-0.5	260	340	430	530	640	770	900	1040	1200	1360
0.0	-1.0	260	340	440	550	670	810	950	1110	1280	1460
0.0	-1.5	250	340	450	570	710	870	1040	1220	1410	1610
0.5	-1.5	250	350	460	590	740	910	1090	1280	1490	1690
0.5	-1.0	250	340	440	560	690	830	990	1160	1340	1530
0.5	-0.5	260	340	430	540	650	780	920	1070	1240	1410
0.5	0.0	270	340	430	530	630	750	880	1020	1180	1320
0.5	0.5	270	350	430	520	620	730	850	980	1110	1250
0.5	1.0	280	360	440	520	620	720	830	950	1070	1210
0.5	1.5	300	370	440	530	620	710	820	930	1050	1170



Each curve shows the collector cell volume at specific times after the pumps have been switched off.

MEL/DEACTIVATION - USE OF MAGNETIC LEVEL INDICATORS (MLIS)

G9409341 - GAUT0T0 - FM28B1000000003

FUEL LINE MAINTENANCE BRIEFING (2)

MAINTENANCE TIPS

During a walk-around inspection, it is important to check the surge tank burst disc on the wing lower surface. A white cross should be visible on a black background. If it is not visible, it may indicate a problem with the tank venting system.
During refueling operations, connect a bonding cable between the fuel tanker and a grounding point on the aircraft, typically on the nose or main gear. Connect a grounding cable from a grounding point on the aircraft to the ground.
In case of refueling process abort, information regarding system status can be retrieved via the MCDU in the FCMC REFUEL PARAMETERS menu.

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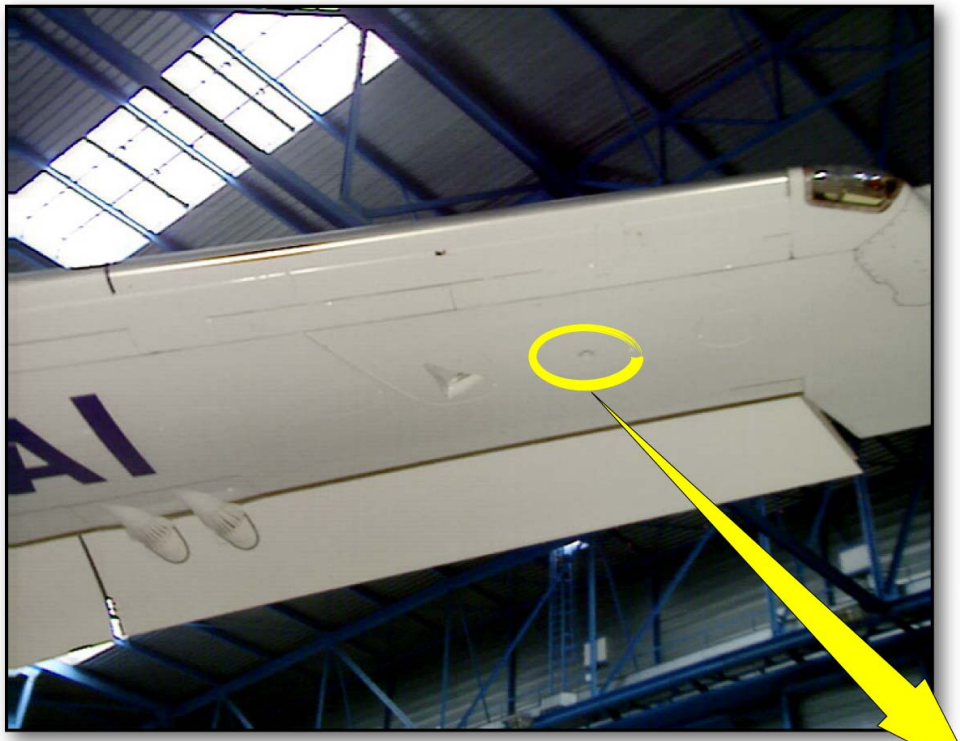
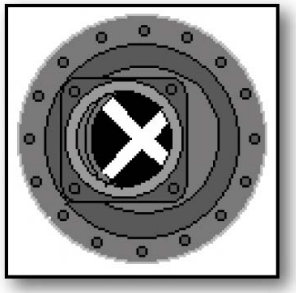
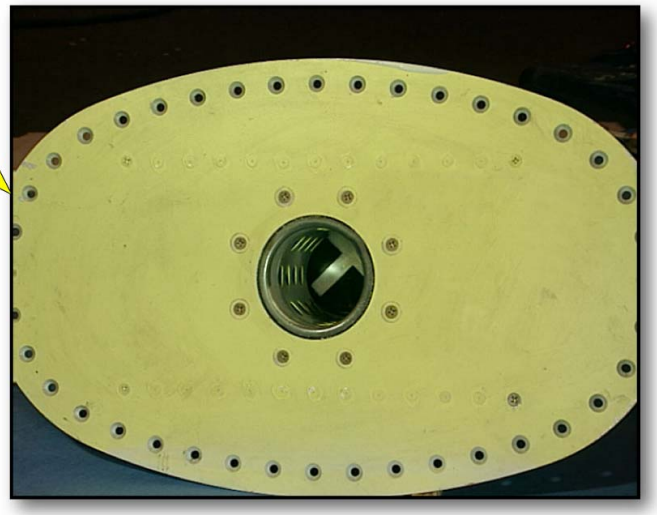


LEFT WING

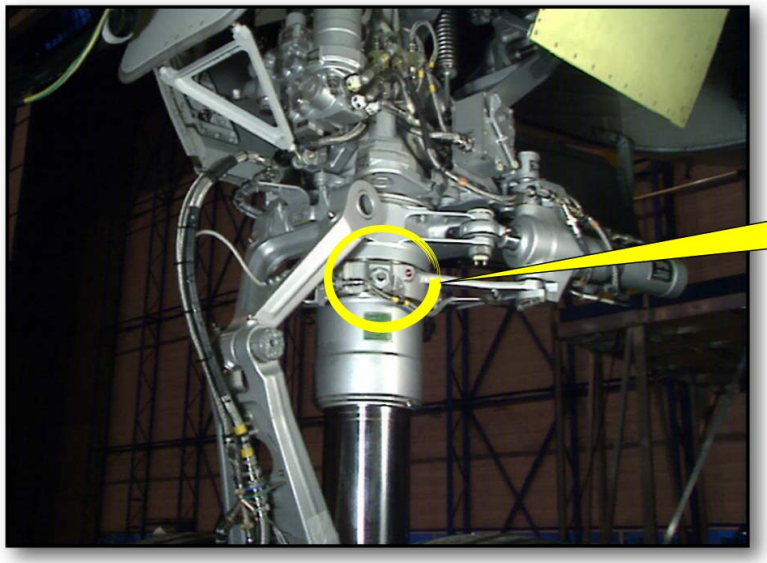


WHITE CROSS ON DISC

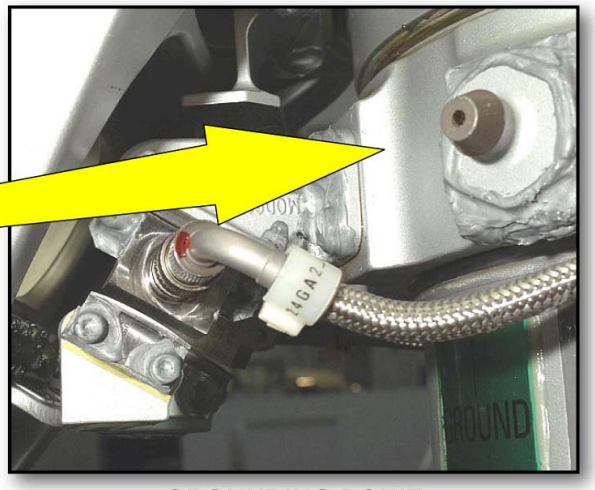


PAINTED CROSS ON DISC

MAINTENANCE TIPS



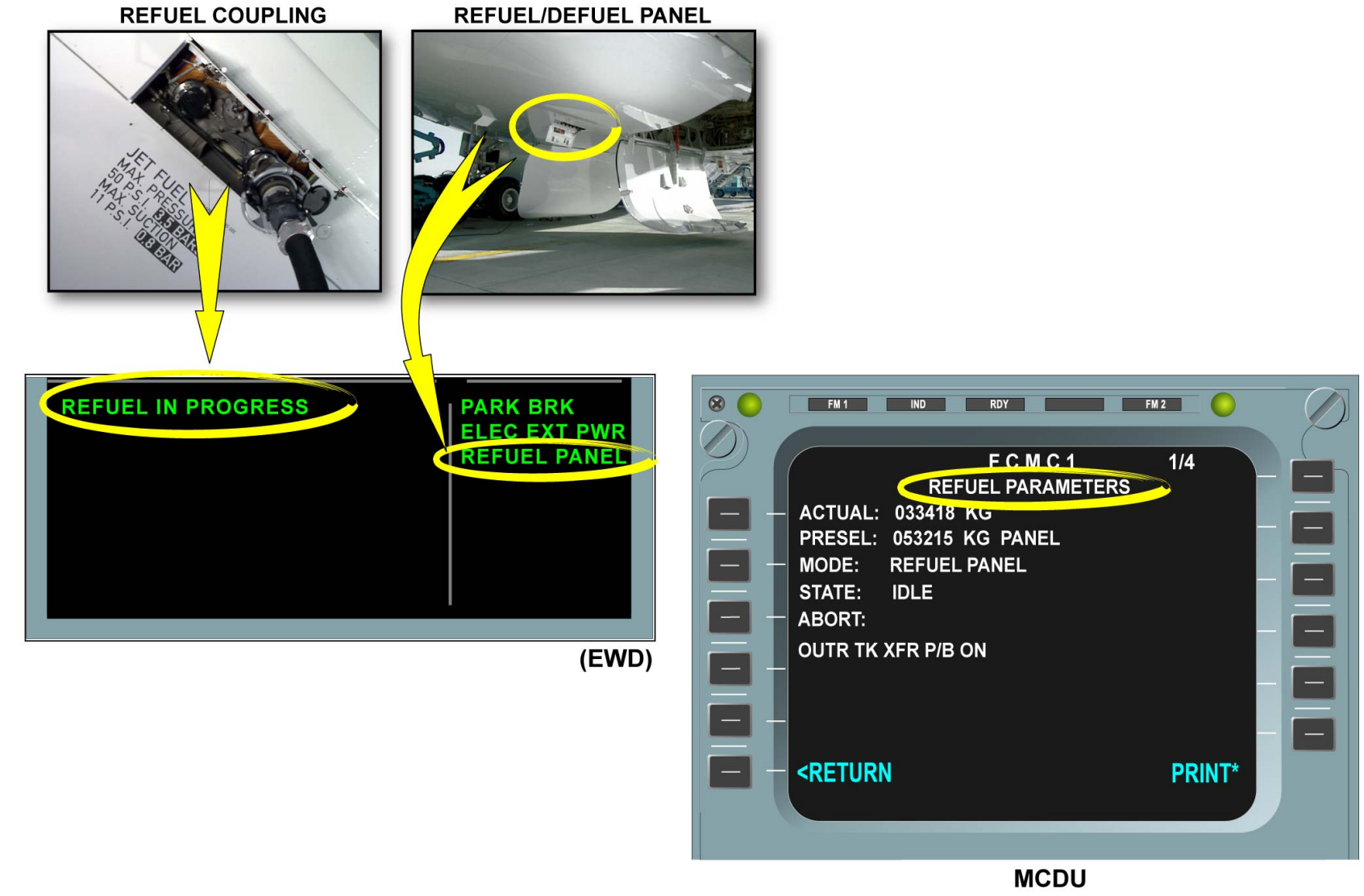
NLG



GROUNDING POINT

MLG GROUNDING POINT

MAINTENANCE TIPS



MAINTENANCE TIPS

FUEL TANK D/O (3)

GENERAL

Each fuel tank is a part of the A/C structure. The inside of each tank is coated with a paint that contains leachable chromate. This chromate helps to prevent microbiological contamination of the fuel tanks. All the materials used to seal the tanks are fully resistant to all fuels and fuel additives.

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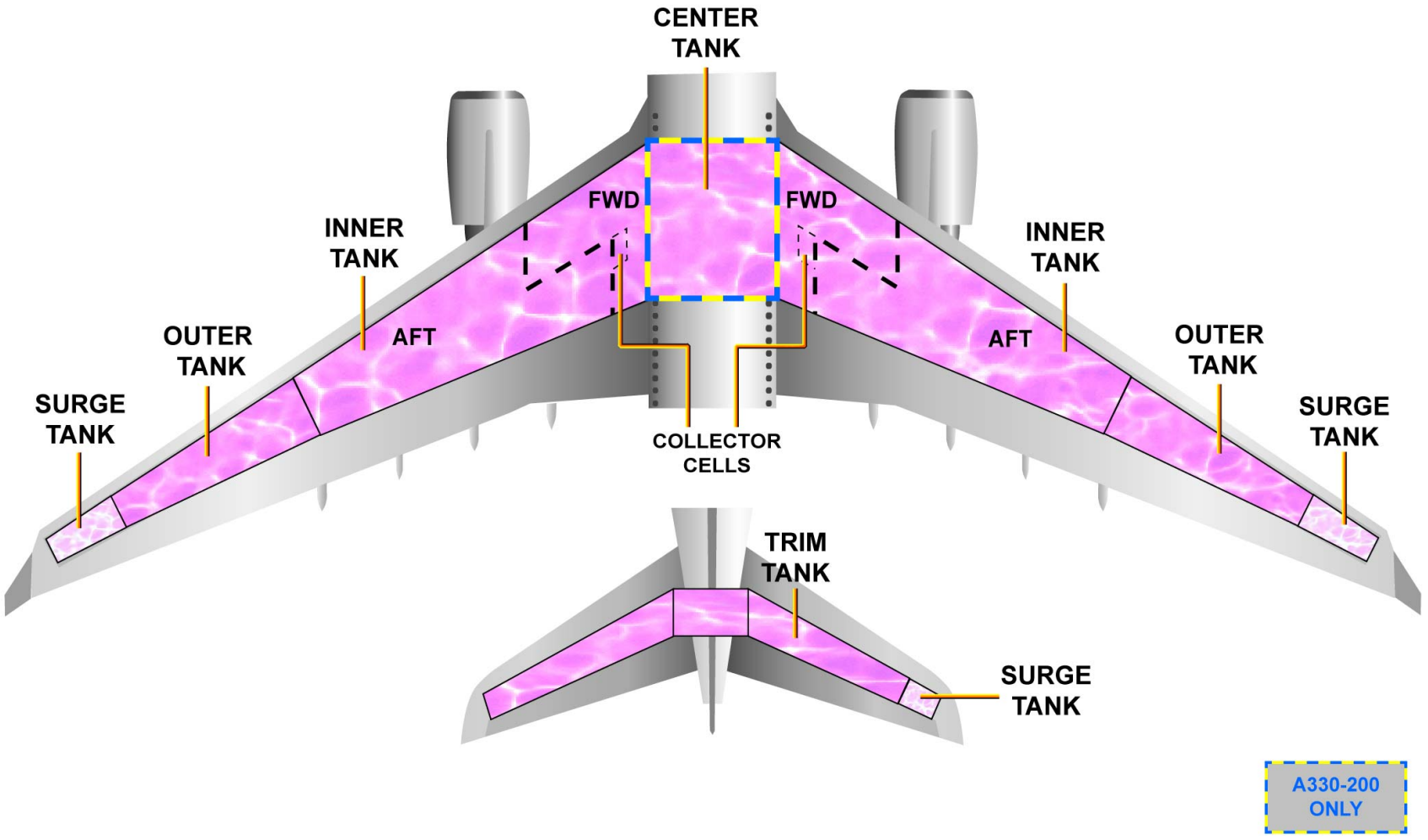

GENERAL

G9409341 - GAUT0T0 - FM28D1000000003

FUEL TANK D/O (3)

TANKS

The fuel is stored in six tanks:
- a center tank (only on the A330-200),
- in each wing: an inner tank divided into two parts, (the FWD inner tank, the aft inner tank) and an outer tank,
- a trim tank.

Vent surge tanks are installed outboard of each outer tank in the wing and on the RH side of the trim tank.

TANKS

The fuel tanks and surge tanks are located as follows:
- the center tank is between the LH rib 1 and the RH rib 1 (only on the A330-200),
- the inner tank is between rib 1 and rib 23,
- the LH (RH) outer tank is between rib 23 and rib 33,
- the LH (RH) surge tank is between rib 33 and rib 39.

The trim tank is made from carbon fiber composite material in the THS main box structure between rib 20 (LH) (19 for the A330-200) and rib 18 (RH). The THS surge tank is at the RH side of the THS between rib 18 and rib 20 (RH).
Access to the tanks is gained through manhole panels.

COLLECTOR CELLS

Each inner tank contains a fuel collector cell which is built between ribs, the center spar and sealed diaphragms FWD of the rear spar. The bottom of ribs 2 is equipped with three flap-type check valves. They let fuel flow into each collector cell and prevent it from flowing out. The top of the collector cell is equipped with openings which let fuel fall back into the inner tanks.

WATER DRAIN VALVES

Each tank has one or more water drain valves. The drain valves are used to:
- drain the water which could possibly come out of the fuel in the tank,
- drain all the remaining fuel out of a tank (for maintenance).

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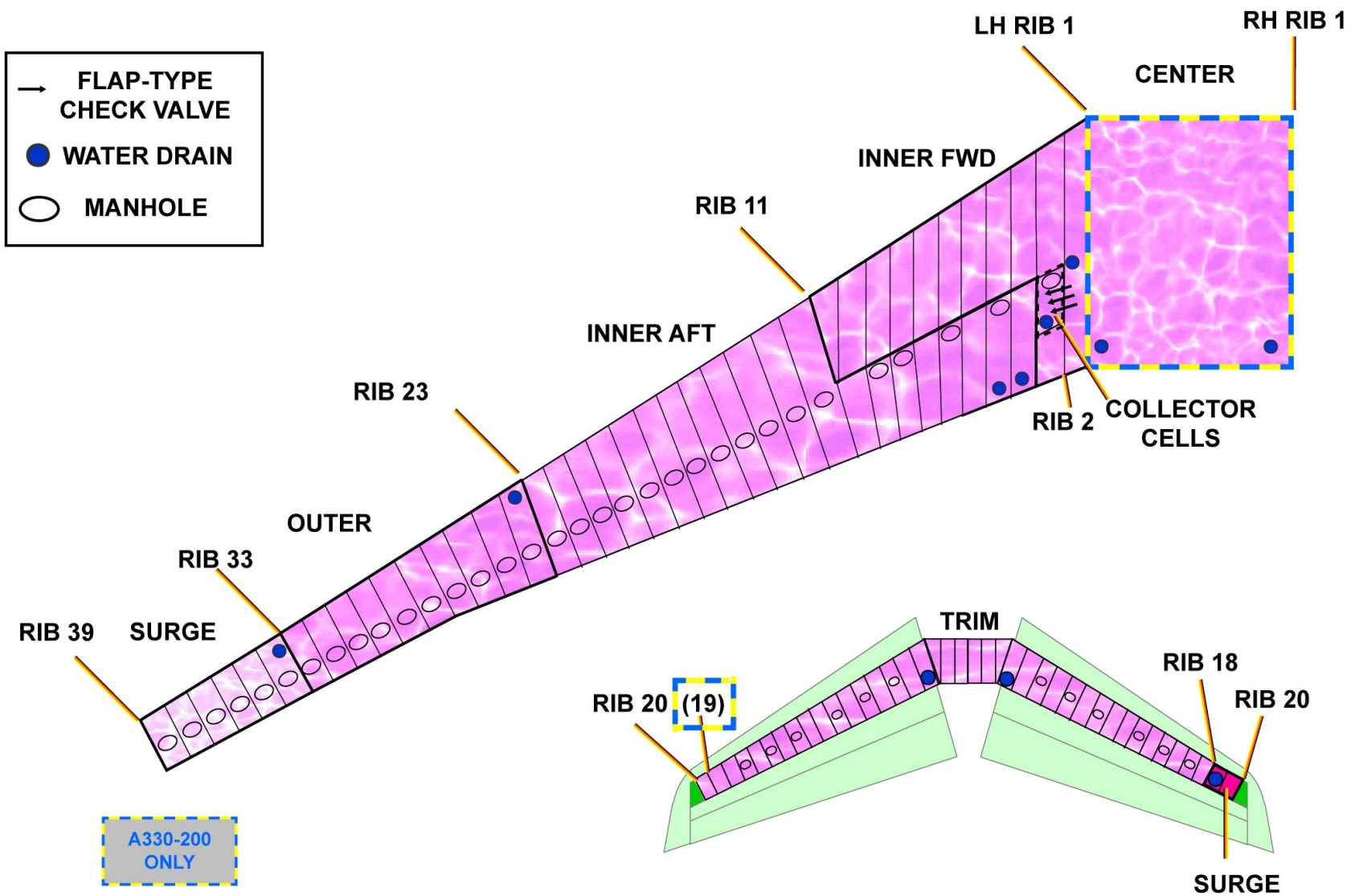

TANKS - TANKS ... WATER DRAIN VALVES

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FUEL TANK D/O (3)

TANKS (continued)

EMERGENCY ISOLATION VALVES

The valves are installed between the AFT and FWD inner tanks.
During normal operation the emergency isolation valves are open.
The crew has to close the split valves to isolate a fuel leak.
An action on the L or R INR TK SPLIT P/BSWs on the FUEL control panel enables manual control of the emergency isolation valves. The fuel is transferred by gravity. When you press one of the INR TK SPLIT P/BSWs, the valves will close ("ON" legend comes on the P/B) and when they are confirmed closed, the "SHUT" legend comes on the P/B.

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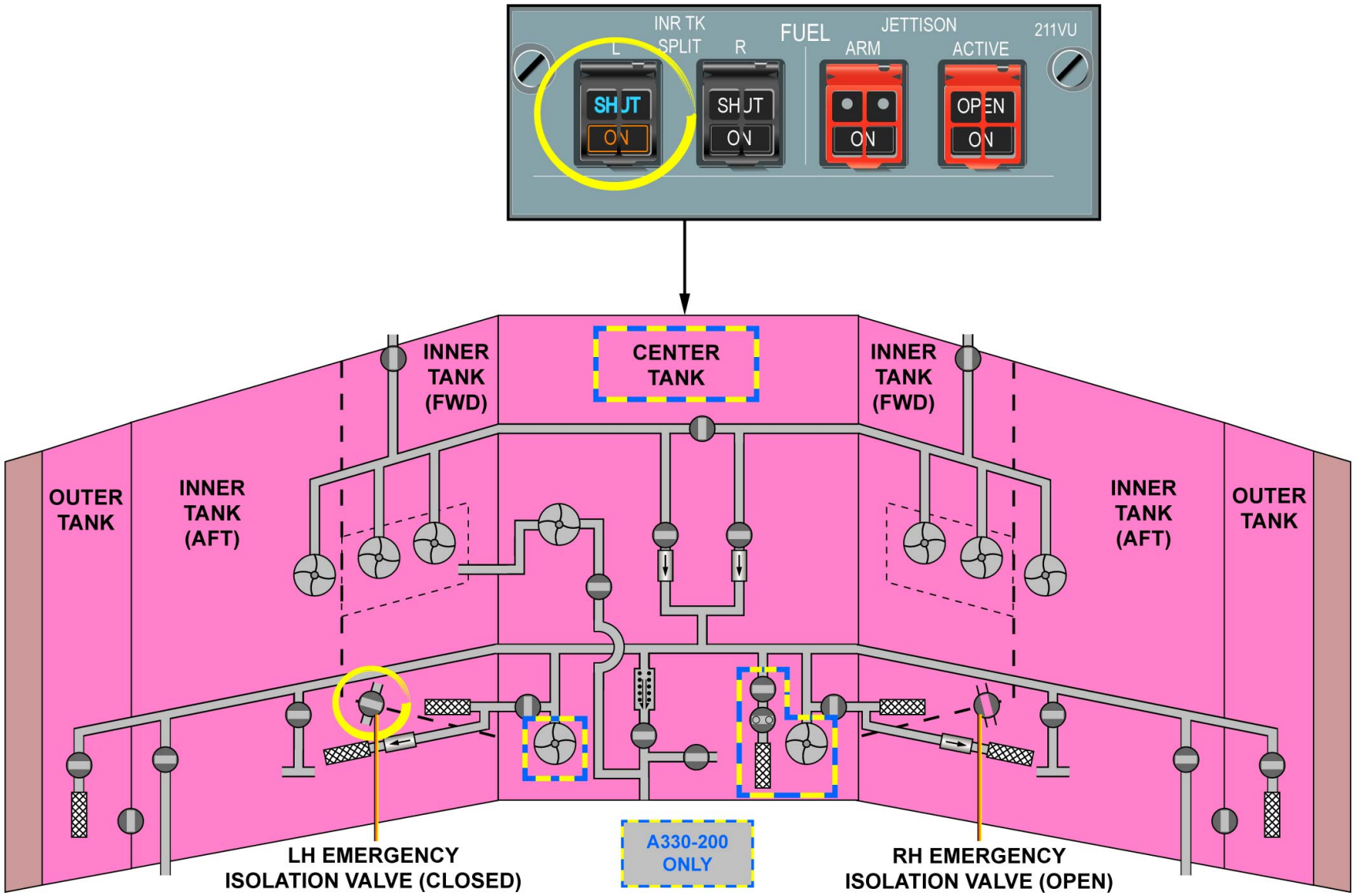

TANKS - EMERGENCY ISOLATION VALVES

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FUEL TANK D/O (3)

TANKS (continued)

TRIM PIPE SHROUD

The trim fuel pipe has an outer shroud. If the trim pipe has a fuel leak, the shroud contains the fuel leakage. The shroud has a fluid drain at its lowest point (FR 47). This drain is a small diameter pipe that connects the shroud to a drain mast. The drain mast is installed on the lower fuselage at FR 53.4.

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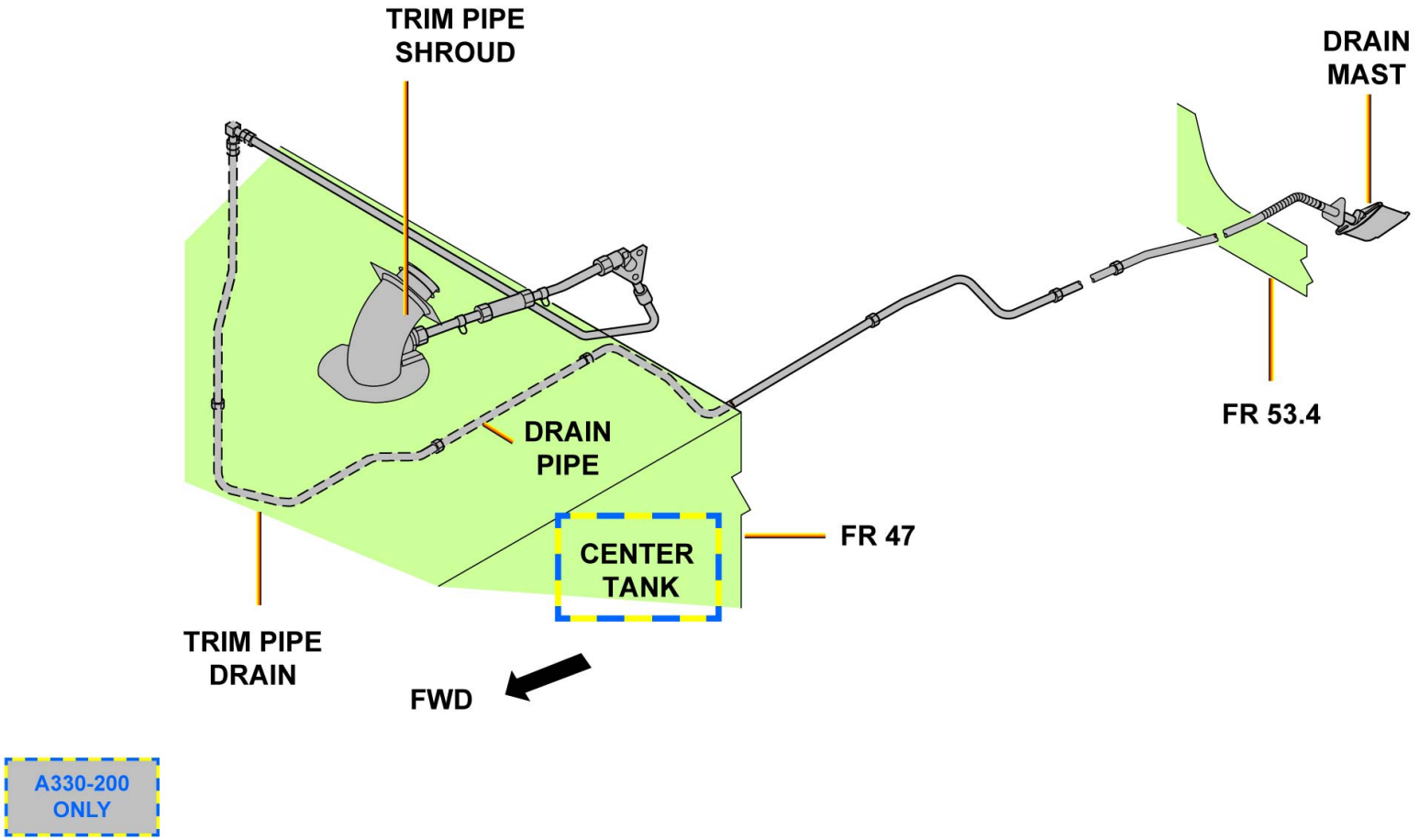

TANKS - TRIM PIPE SHROUD

FUEL TANK VENTING D/O (3)

GENERAL

The tank venting system keeps the air pressure in the fuel tanks near the external air pressure. This function prevents a large difference between these pressures, which could cause damage to the fuel tank structure. This function is particularly necessary during the refuel or defuel operations and when the A/C climbs or descends. Each vent surge tank keeps its related fuel tanks open to the ambient air pressure. The operation of the tank venting system is fully automatic. There are no manual controls. The tank venting system is divided into two systems. These are:
- the wing and center tanks venting system,
- the trim tank venting system.

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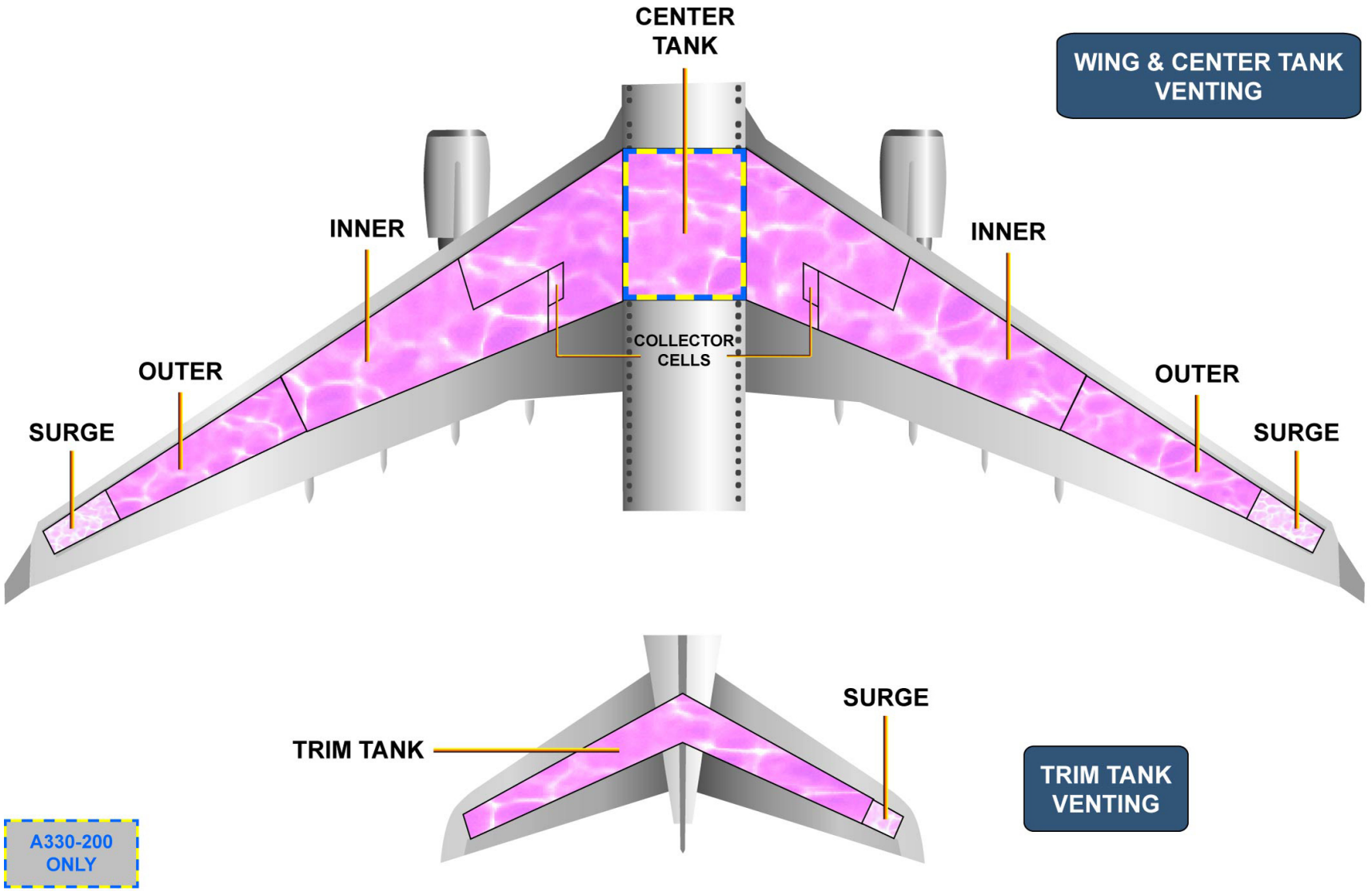

GENERAL

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FUEL TANK VENTING D/O (3)

VENTING

Let's see in details the venting system.

WING & CENTER TANKS VENTING

For the A330-200 A/C, the center tank vent pipe has an open-end fitting at each end. The pipe connects the middle of the center tank to the LH surge tank at rib 33.
The LH (RH) inner tank vent pipe connects the inboard end of the tank to the surge tank. The pipe has two open-end fittings at its inboard end. A weir duct is installed between rib 22 and rib 23. The weir duct makes sure that the fuel does not go to the vent valve during a refuel operation.
The outer tank vent pipe connects the open-end fitting, inboard of rib 33 to the inner tank vent pipe, between the weir duct and rib 22.
The surge tank has a drain pipe which connects the bottom of the surge tank, at rib 33, to the inner tank vent pipe, outboard of rib 29.
The bottom of each vent pipe includes a breather assembly at different locations. If fuel goes into the vent pipe, the breather assembly lets the fuel drain back into the tank.
The inner and outer tanks each have vent valves which are connected to the related vent pipe. The vent valves close when the fuel level near them increases, and open when the fuel level decreases. This function helps to make sure that fuel does not get into the vent pipes.
Overpressure protectors are installed in the center tank and in the bottom of the surge tank. They make sure the pressure in the center tank or in the surge tank, and thus the inner and outer tanks, does not exceed the design limits. They prevent too high differential pressure.
If the pressure in the center tank increases to a specified value the overpressure protectors break open to release the pressure into the inner tank. If the flow of air into or out of the surge tank is blocked, the overpressure protector breaks open to release the pressure. If fuel enters the surge tank and causes the overpressure protector to operate, then this fuel will go overboard.
A NACA intake is mounted on the access panel of each surge tank. The stack pipe connected to the NACA duct is equipped with a flame arrestor. If a ground fire occurs, it prevents the ignition of the fuel vapor in the surge tank. It also lets air flow freely through it in both directions. If fuel comes out of the overpressure protector, it could go inboard along the wing. A wing fence makes sure that such fuel falls off the wing.

TRIM TANK VENTING

The trim tank is composed of a main vent pipe and a secondary vent pipe. At different locations, a breather assembly is attached to the bottom of each vent pipe and lets the fuel drain back into the trim tank.
The vent valve installed on the inboard-face of RH rib 18 and connected to the main vent pipe makes sure the RH part of the trim tank is open to the surge tank in level flight and during refuel/defuel operations.
The two inner vent valves connected to the main vent pipe make sure the trim tank is open to the surge tank when the A/C climbs.
The LH outer tank vent valve connected to the secondary vent pipe and attached inboard of LH rib 20 closes when the fuel level near to the valve increases.
In the trim surge tank, the NACA intake, flame arrestor and overpressure protector are of the same type as for the wing venting system. If fuel gets into the trim surge vent tank, a check valve installed on the inboard face of RH rib 18 lets this fuel flow back into the trim tank.

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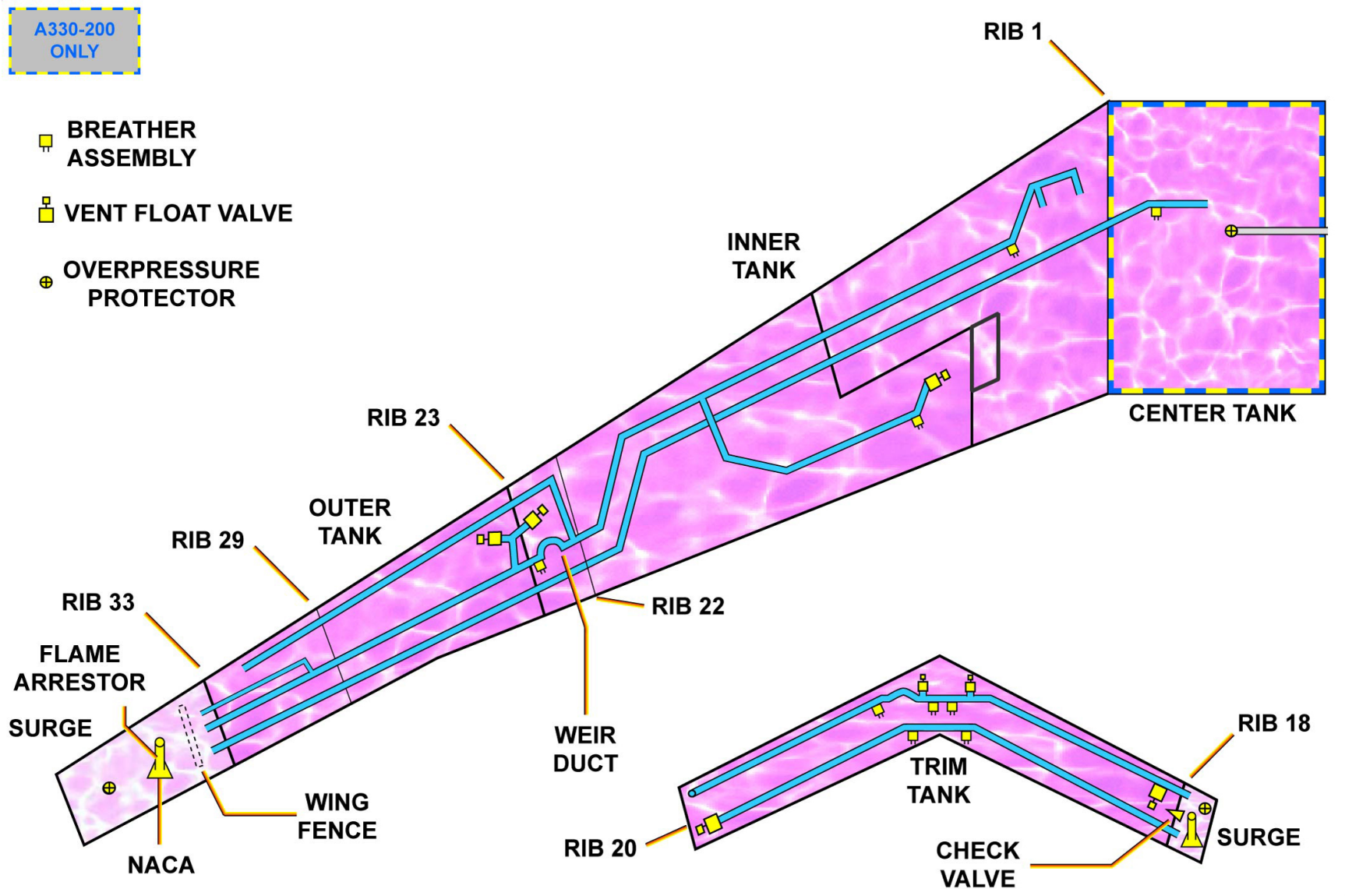

VENTING - WING & CENTER TANKS VENTING & TRIM TANK VENTING

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FUEL TANK INDICATING D/O (3)

GENERAL

The indicating systems are: Fuel Quantity Indicating (FQI), tank level sensing and temperature measurement.
All this data is sent to the Fuel Control and Monitoring Computers (FCMCs), which transmit it to the ECAM FUEL page and the refuel/defuel control panel.
In case of fuel quantity indication failure, the fuel quantity in the outer tanks, the inner tanks and the center tank can be measured using Manual Magnetic Indicators (MMIs).

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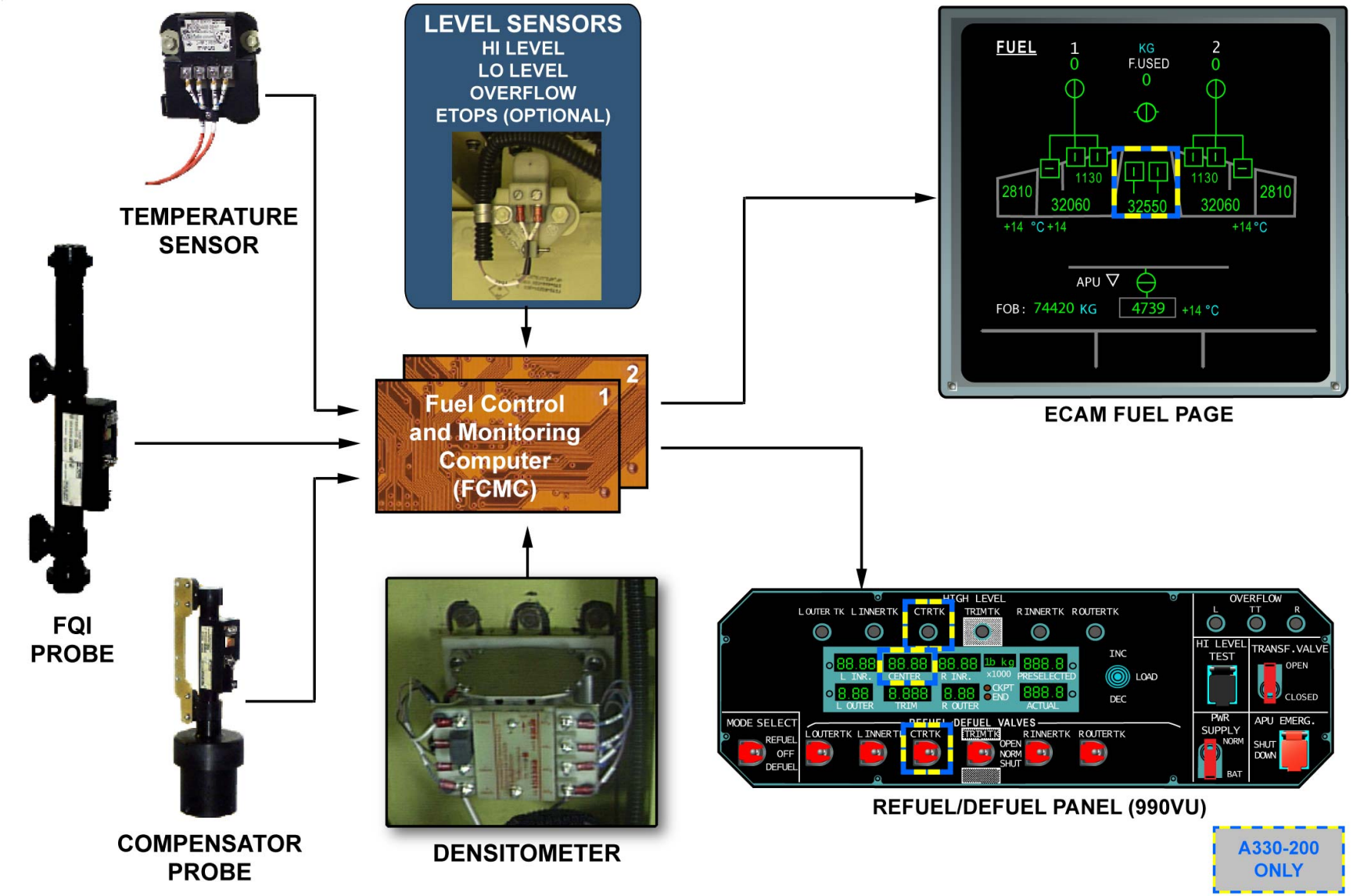
LEVEL SENSORS
HI LEVEL
LO LEVEL
OVERFLOW
ETOPS (OPTIONAL)
TEMPERATURE SENSOR
FQI PROBE
COMPENSATOR PROBE
Fuel Control and Monitoring Computer (FCMC)
1
2
DENSITOMETER
FUEL
KG
F.USED
ECAM FUEL PAGE
HIGH LEVEL
OVERFLOW
HI LEVEL TEST
TRANSF.VALVE
MODE SELECT
REFUEL
OFF
DEFUEL
DEFUEL VALVES
PWR SUPPLY
APU EMERG.
REFUEL/DEFUEL PANEL (990VU)
A330-200 ONLY

GENERAL

FUEL TANK INDICATING D/O (3)

INDICATING

In this topic we shall describe the indicating functions.

FQI PROBES

A set of capacitive probes is installed in each fuel tank. Each probe has a capacitance value which changes in proportion to the depth of fuel in the related tank. The FCMCs continuously measure the capacitance values of all the FQI probes. They then use each set of probes capacitance values to determine the quantity (volume) of fuel in the tank.

COMPENSATORS

The fuel compensators are installed near to the lowest point in the inner tanks with another in the center tank for A330-200 configuration only. The compensator probes operate only when they are fully immersed in fuel and have a capacitance, which is in proportion to the dielectric constant of the fuel. They are used for fuel permittivity determination.

DENSITOMETERS

One densitometer is installed near the lowest point of each inner tank. The densitometersare used by the FCMCs to determine the density of the fuel. After having calculated the volumes of fuel using the FQI probes, the FCMCs are now able to calculate the weight of fuel in each tank

TEMPERATURE SENSORS

6 temperature sensors interface with the FCMCs and are arranged as follows:
- 1 fitted in the LH outer tank,
- 1 fitted in each collector cell,
- 1 fitted in the trim tank.

Each temperature sensor is installed near the lowest part of the tank. This makes sure that the temperature sensor is kept in the fuel most of the time. The electrical resistance of the temperature sensors changes in proportion to the fuel temperature. These sensors are to give the fuel temperature of the different tanks on the ECAM Fuel page and also for fuel LO TEMP or HI TEMP warning activation.

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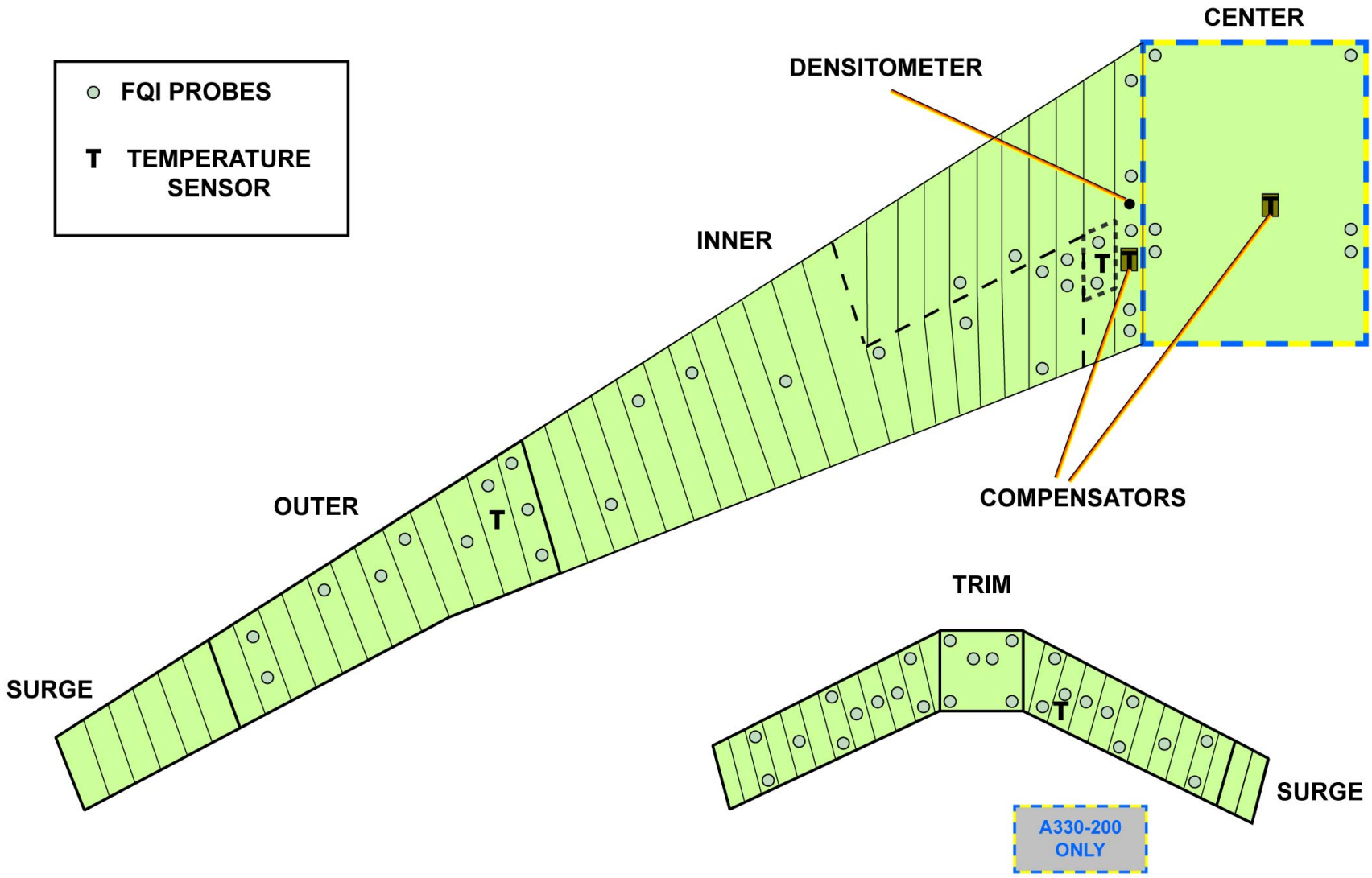

INDICATING - FQI PROBES ... TEMPERATURE SENSORS

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FUEL TANK INDICATING D/O (3)

INDICATING (continued)

FUEL LEVEL SENSING

Each FCMC uses fuel level sensing data coming from the following sensors:
- High level sensors,
- Low level sensors,
- Overflow sensors,
- ETOPS sensors (optional).

For each FCMC applicable level sensing area, one probe is connected to FCMC 1 and the other to FCMC 2. FCMC 1 or 2 receives the opposite FCMC level sensing by cross-wired discretes.

Each level sensor is fitted with a thermistor. The FCMC measures the difference in resistance of the thermistor to determine when the sensor is in the fuel or out of the fuel.

All high level sensors and overflow sensors have a fail state "WET" whereas the low level sensors have a fail state "DRY"

The high level sensors are installed by pairs in each tank. Each sensor of a pair sends signal to a different FCMC. When both high level sensors of a fuel tank become wet, the FCMC that is in control closes the related tank inlet valve.

The high level sensors of the center tank (A330-200 only) are installed at a different height. During refueling, when the lowest sensor becomes wet, the FCMC closes the center tank inlet restrictor valve. Then when the highest sensor becomes wet, the FCMC closes the center tank inlet valve. This permits to get a smooth end of refueling of the center tank.

The low level sensors are fitted in each tank except in the outer tanks. Two sensors are installed in each inner tank, one sensor in the center tank (A330-200 only) and one sensor in the trim tank. They are used to control fuel operations and to trigger low level warnings.

- When any inner tank low level sensor becomes dry, the FCMC stops the jettison operation, if selected. The inner tank low level quantity is 1600 kg (3520 lb).
- When the center tank low level sensor is dry, the FCMC stops the operation of the center tank transfer pumps.
- When the trim tank low level sensor is dry, the FCMC closes the trim tank isolation valve to make sure the trim tank and the trim pipe do not drain.

One overflow sensor is installed in each surge tank. The overflow sensor may become wet during refueling. In such a case the FCMC closes all inlet valves, the refuel isolation valve and triggers an ECAM warning.

A wing overflow sensor becomes wet when there are 450 liters in the surge tank.

Optionally, one ETOPS warning sensor can be fitted in each inner tank. These sensors are installed at a height corresponding to a fuel quantity that is sufficient for 180 minutes flying. When one of the ETOPS warning sensors becomes dry, the FCMC sends a FUEL ETOPS RESERVE / FOB BELOW 17T warning.

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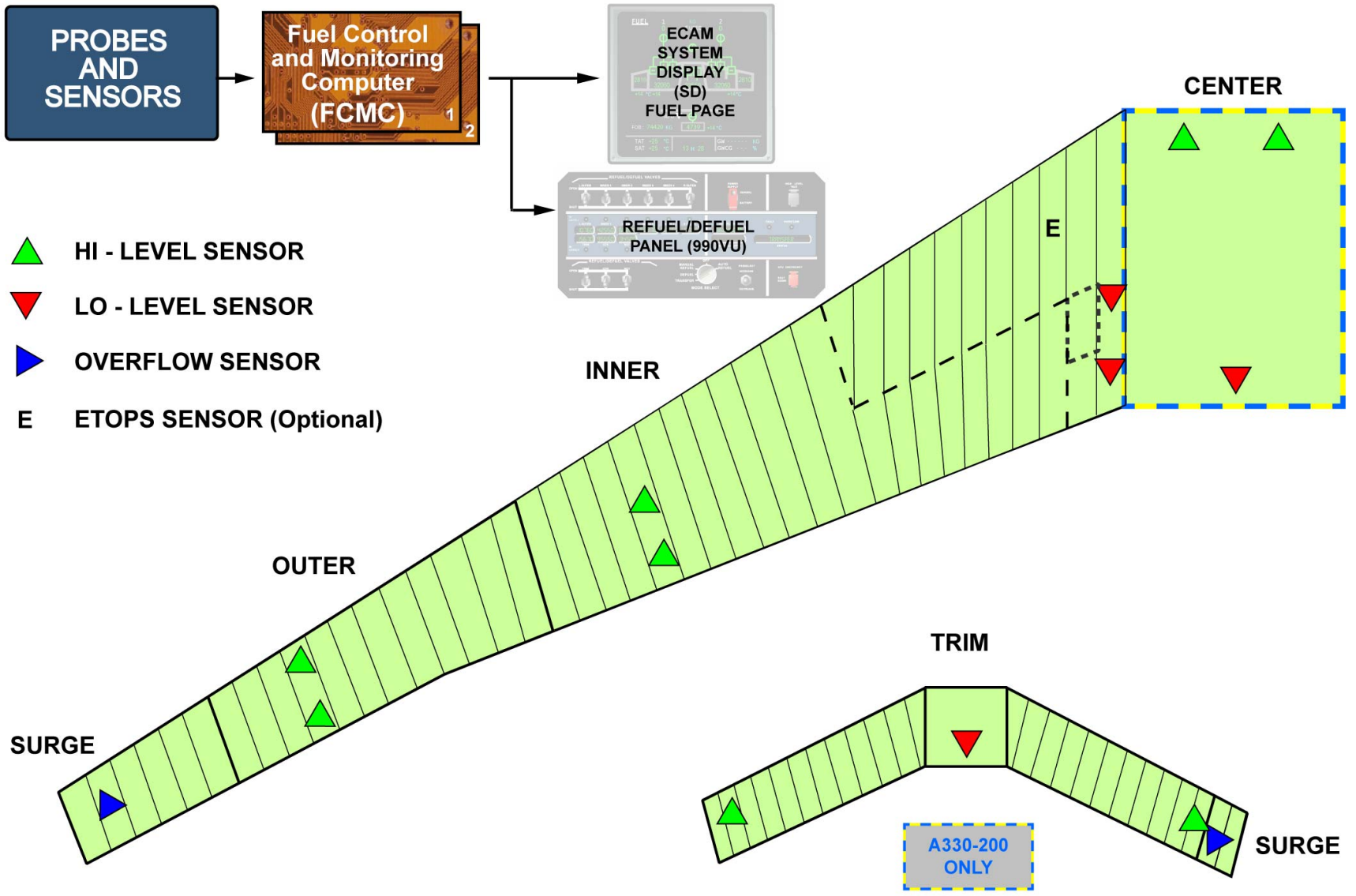

INDICATING - FUEL LEVEL SENSING

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FUEL TANK INDICATING D/O (3)

INDICATING (continued)

FCMC MEASUREMENT

Both FCMCs receive:
- fuel data from the different probes,
- THS position from both Flight Control Data Concentrators (FCDCs),
- aircraft attitude, acceleration and pitch and roll angles from the 3 Air Data and Inertial Reference Units (ADIRUs).

With this data, each FCMC performs all fuel quantity and temperature measurements and indications.

Each FCMC contains the COMmand, MONitor and integrity checker processors. Each processor concurrently computes fuel quantity and temperature measurements using different software and different information sources to provide reliable data.

COM and MON processors compute usable fuel quantity in the tank using computed fuel surface attitude derived from FQI probe capacitance values and the fuel permittivity. They use the fuel volume calculation together with the density data to find the fuel mass (fuel quantity), which is more appropriate than volume. The data is then transmitted to the ECAM FUEL page and to the refuel panel indicator. The refuel panel indicator is slave to the FCMCs displaying the ARINC 429 received data.

The level sensing operates independently inside the FCMC. Each FCMC has an independent level sensing board interfacing with a maximum of 14 level sensing channels. Each FCMC uses all level sensing data for command computation and warning activation.

For each FCMC applicable level sensing area, one sensor is connected to FCMC 1 and the other to FCMC 2. FCMC 1 (or 2) receives the opposite FCMC level sensing status by cross-wired discretes.

The FUEL QUANTITIES menu enables to access the fuel quantities of any fuel tanks. The INPUT PARAMETERS menu gives access to the fuel permittivity, density and temperature data.

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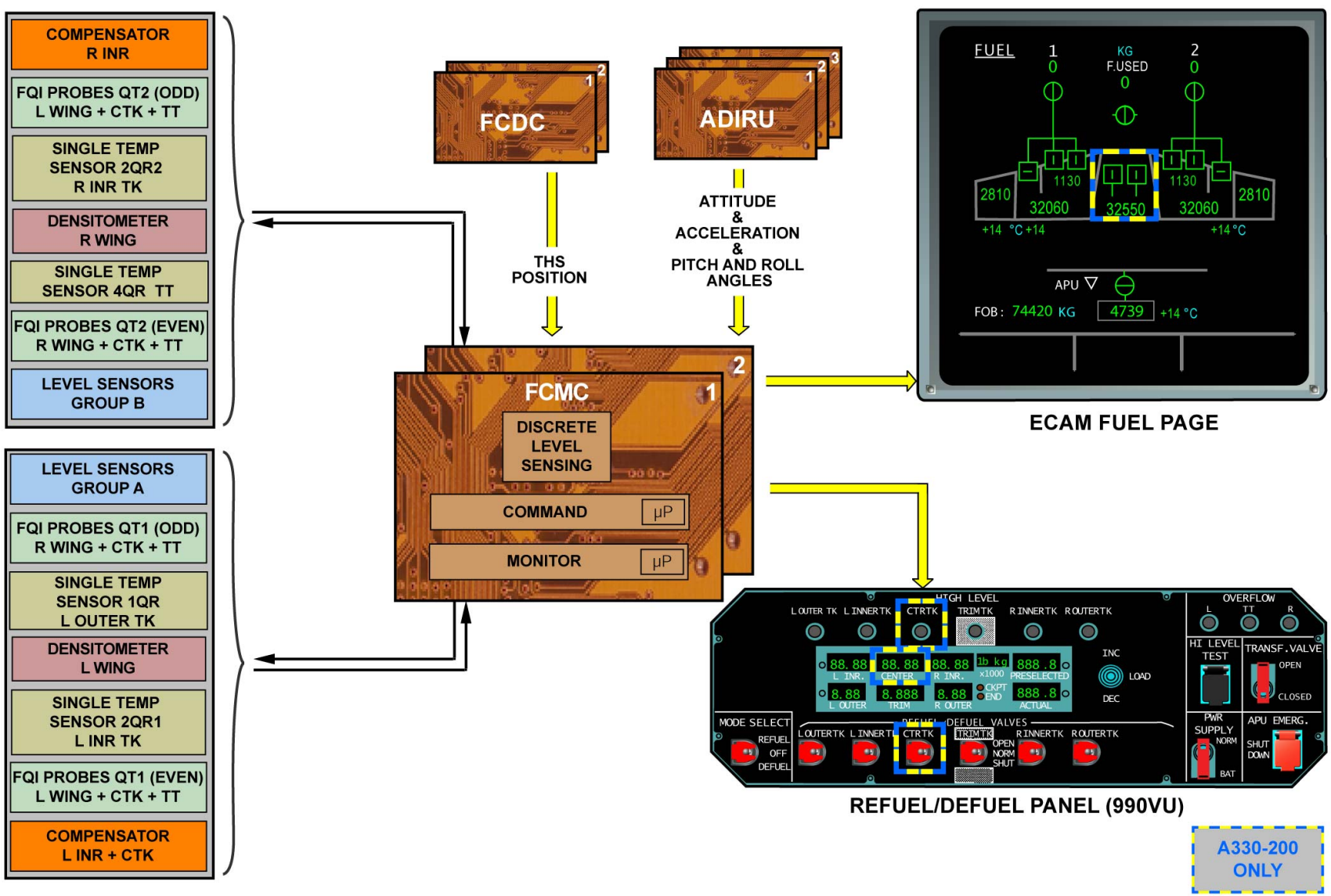

INDICATING - FCMC MEASUREMENT

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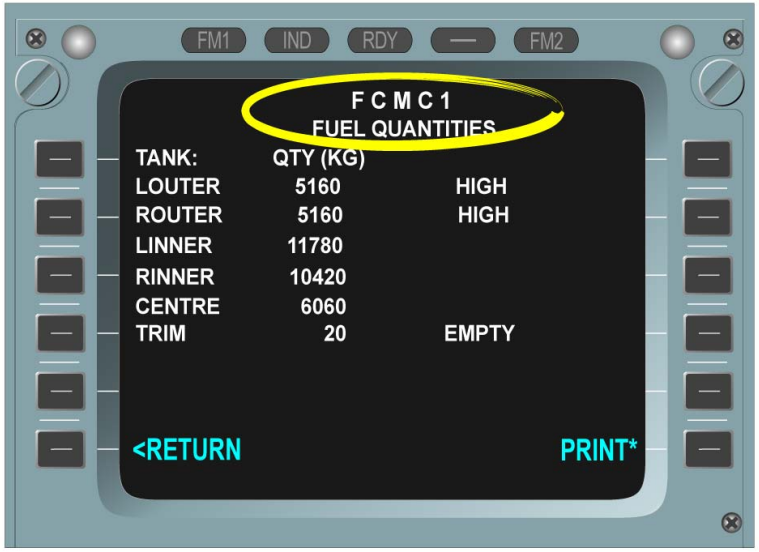

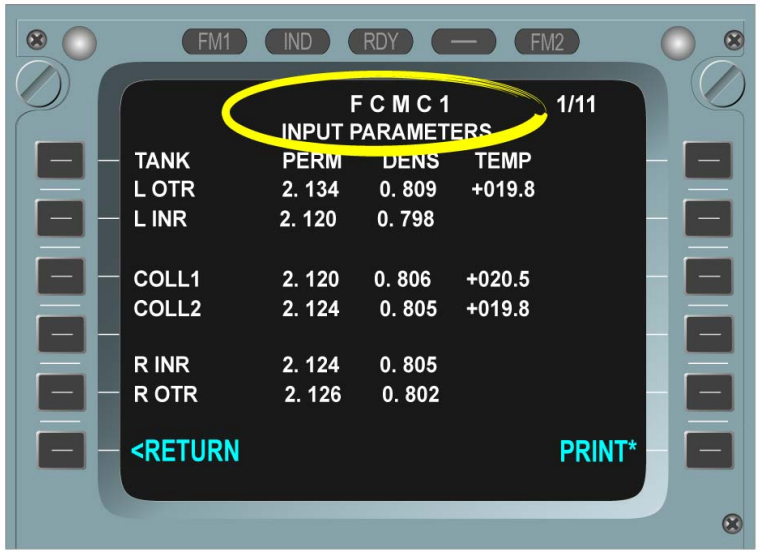

INDICATING - FCMC MEASUREMENT

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FUEL TANK INDICATING D/O (3)

INDICATING (continued)

REFUEL/DEFUEL PANEL INDICATIONS

The fuel quantity indicator of the Refuel/Defuel panel displays the quantity of fuel in each tank, the actual total fuel quantity in the aircraft, and the preselected fuel quantity used for automatic refueling. The high level lights come on blue when the related fuel tank high level sensors are wet. An amber overflow light comes on if the associated surge tank sensor becomes wet. Each light has a filament press-to-test facility that permits to check the integrity of the lamp. The HI-LEVEL TEST P/BSW is used to test the high level and overflow sensors and their associated circuits. When this P/BSW is pressed, the status of all high level lights and overflow lights is inverted. In addition, the fuel quantity indicator shows "8s", the CKPT and END lights come on.

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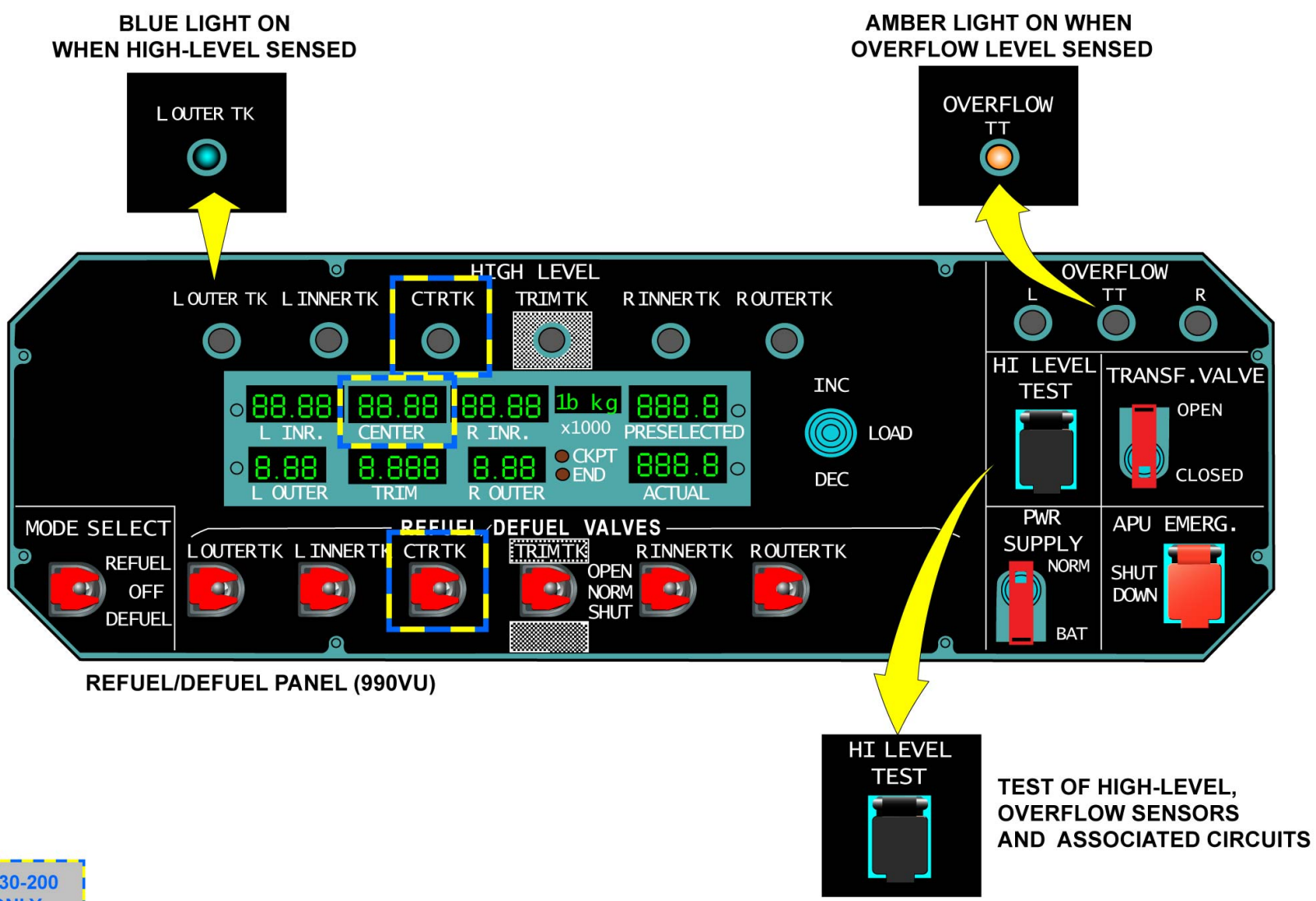

INDICATING - REFUEL/DEFUEL PANEL INDICATIONS

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FUEL TANK INDICATING D/O (3)

INDICATING (continued)

FUEL QUANTITY INDICATION DEGRADATION/FAILURE

A degraded fuel quantity indication is identified by amber dashes on the last two digits of tank quantity and total fuel quantity indications on ECAM and on the Refuel panel. It is detected by the FCMC when the fuel quantity in any tank cannot be determined with the nominal accuracy, but remains within an acceptable accuracy level. A degraded fuel quantity indication does not impact the aircraft dispatch conditions.

A failed fuel quantity indication is identified by amber XX in place of the failed tank quantity and total fuel quantity indications on ECAM and on the Refuel panel. It is detected by the FCMC when the fuel quantity in any tank cannot be determined within an acceptable accuracy level. A dedicated MEL item gives the corresponding aircraft dispatch conditions, including a manual calculation of tank quantity after refueling using the Magnetic Level Indicators (MLI), except for the trim tank.

A failed or mis-reading probe can be identified via the FCMC INPUT PARAMETERS menu on the MCDU. Any degraded or failed quantity indication is respectively signaled by "?" or "---.-" indications in place of the corresponding probe capacitance value. The identification and Functional Item Number (FIN) of the affected probe can be retrieved using dedicated tables in AMM 28-51-00 chapter.

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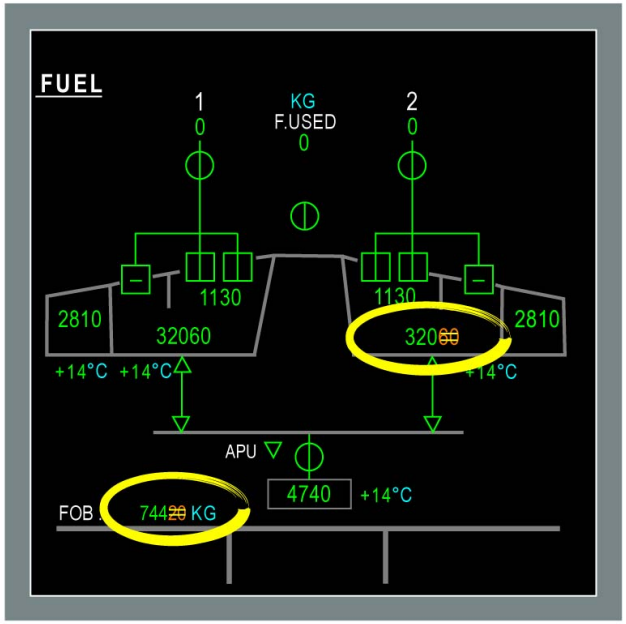
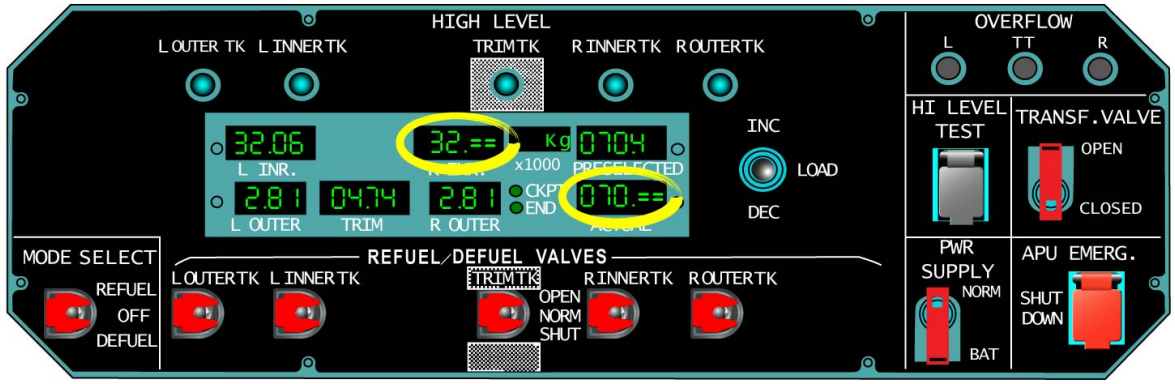
A330-300 RIGHT INNER "DASHED" (SERVICEABLE)

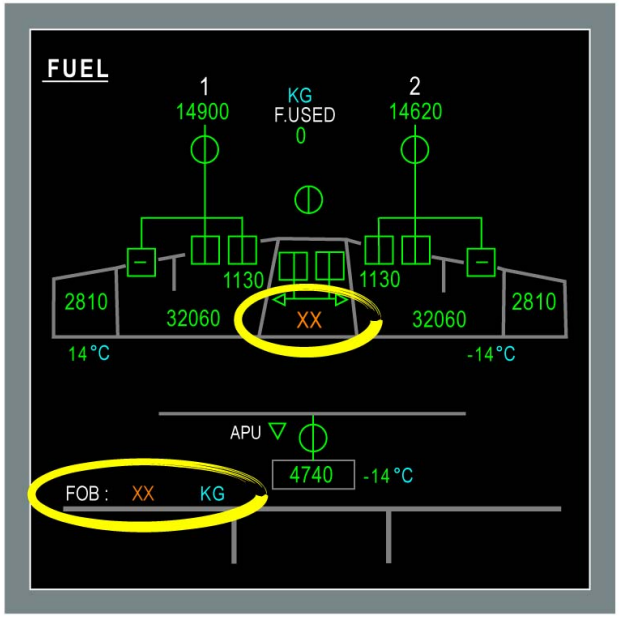


REFUEL/DEFUEL PANEL (990VU)

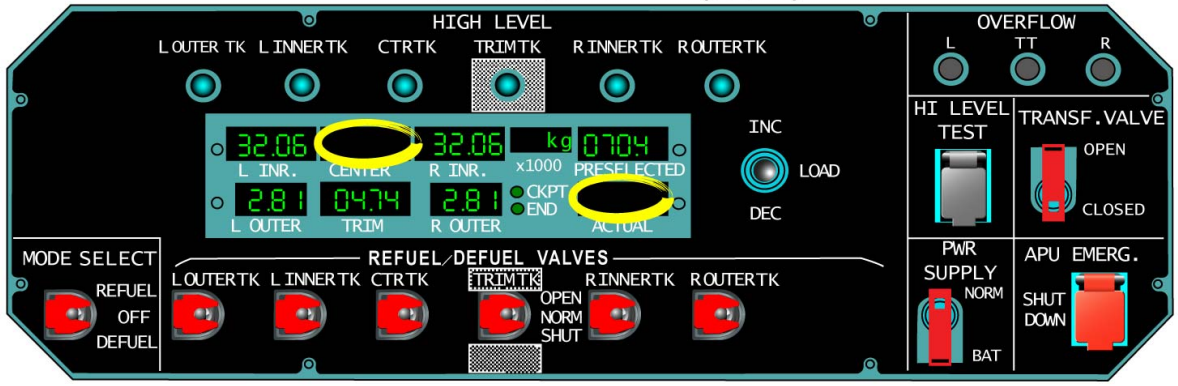


INDICATING - FUEL QUANTITY INDICATION DEGRADATION/FAILURE

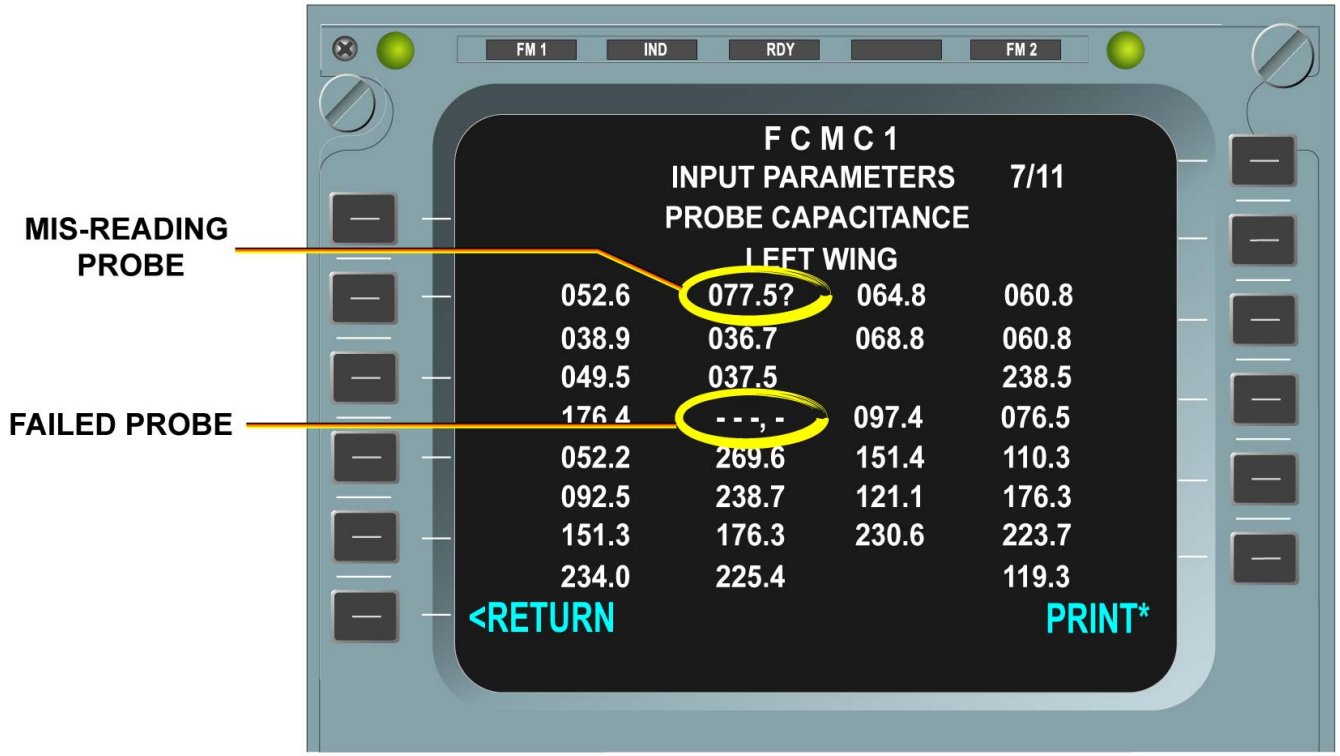
A330-200 CENTER TANK INDICATION INOP



REFUEL/DEFUEL PANEL (990VU)



INDICATING - FUEL QUANTITY INDICATION DEGRADATION/FAILURE



INDICATING - FUEL QUANTITY INDICATION DEGRADATION/FAILURE

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NOTES: 1. IF THE FCMC CALCULATES THAT A PROBE IS UNSERVICEABLE, THE APPLICABLE DISPLAY WILL SHOW A '-' (DASH).

NOTES: 2. THE WET MAX VALUE IS WITH THE PROBE FULLY IMMERSED AND WITH 'K' = 2.3.

AMM 28-51-00 used to retrieve indentification of faulty probes.

GRID:	A	B	C	D	
01		FCMC 1			
02		INPUT PARAMETERS 7/11			
L1 03		PROBE CAPACITANCE			R1
04		LEFT WING			
L2 05	052.6	077.5	064.8	060.8	R2
06	038.8	036.7	066.8	060.8	
L3 07	049.5	037.5		238.5	R3
08	176.4	121.0	097.4	076.5	
L4 09	052.2	289.6	151.4	110.3	R4
10	092.5	238.7	121.1	176.3	
L5 11	151.3	176.3	230.6	223.7	R5
12	234.0	225.4		119.3	
L6 13	<RETURN			PRINT*	R6
14					

			CAPACITANCE VALUES		
GRID REF	FIN	LRU IDENTIFICATION	DRY	TOLERANCE	WET MAX
A05	17QT1	LEFT OUTER TANK PROBE 1	24.91	+/- 0.51	57.81
B05	15QT1	LEFT OUTER TANK PROBE 2	38.44	+/- 0.57	85.10
C05	13QT1	LEFT OUTER TANK PROBE 3	30.60	+/- 0.54	71.27
D05	11QT1	LEFT OUTER TANK PROBE 4	28.79	+/- 0.53	67.00
A06	9QT1	LEFT OUTER TANK PROBE 5	24.91	+/- 0.51	57.81
B06	16QT1	LEFT OUTER TANK PROBE 6	17.36	+/- 0.47	40.14
C06	14QT1	LEFT OUTER TANK PROBE 7	32.54	+/- 0.55	75.69
D06	12QT1	LEFT OUTER TANK PROBE 8	28.79	+/- 0.53	67.00
A07	10QT1	LEFT OUTER TANK PROBE 9	27.06	+/- 0.52	62.90
B07	8QT1	LEFT OUTER TANK PROBE 10	24.91	+/- 0.51	57.81

INDICATING - FUEL QUANTITY INDICATION DEGRADATION/FAILURE

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FUEL TANK INDICATING D/O (3)

INDICATING (continued)

MANUAL MAGNETIC INDICATORS

All the wing Manual Magnetic Indicators (MMIs) are installed in the bottom surface of the fuel tanks. Access to the Magnetic Level Indicators (MLIs) is from below the wing. The MMIs are installed as follows:

- 4 in each inner tank,
- 1 in the center tank,
- 2 in each outer tank.

Each MMI has an MLI contained in its related Magnetic Level Indicator Housing (MLIH).

The center tank has two MLIHs. The upper housing is installed in the bottom skin of the center tank. The lower housing is installed in the belly fairing immediately below the upper housing. The center tank MMI extends from the fuel tank bottom to the A/C bottom skin. When an MLI is extended from its related housing, the fuel level in that area of the fuel tank can be measured. To measure the quantity of fuel in the wing tanks it is necessary to:

- extend and read the MLIs,
- use the ADIRS to read the attitude of the A/C (in pitch and roll),
- measure the specific gravity of the fuel.

A set of mathematical tables is then used to make the fuel quantity calculation.

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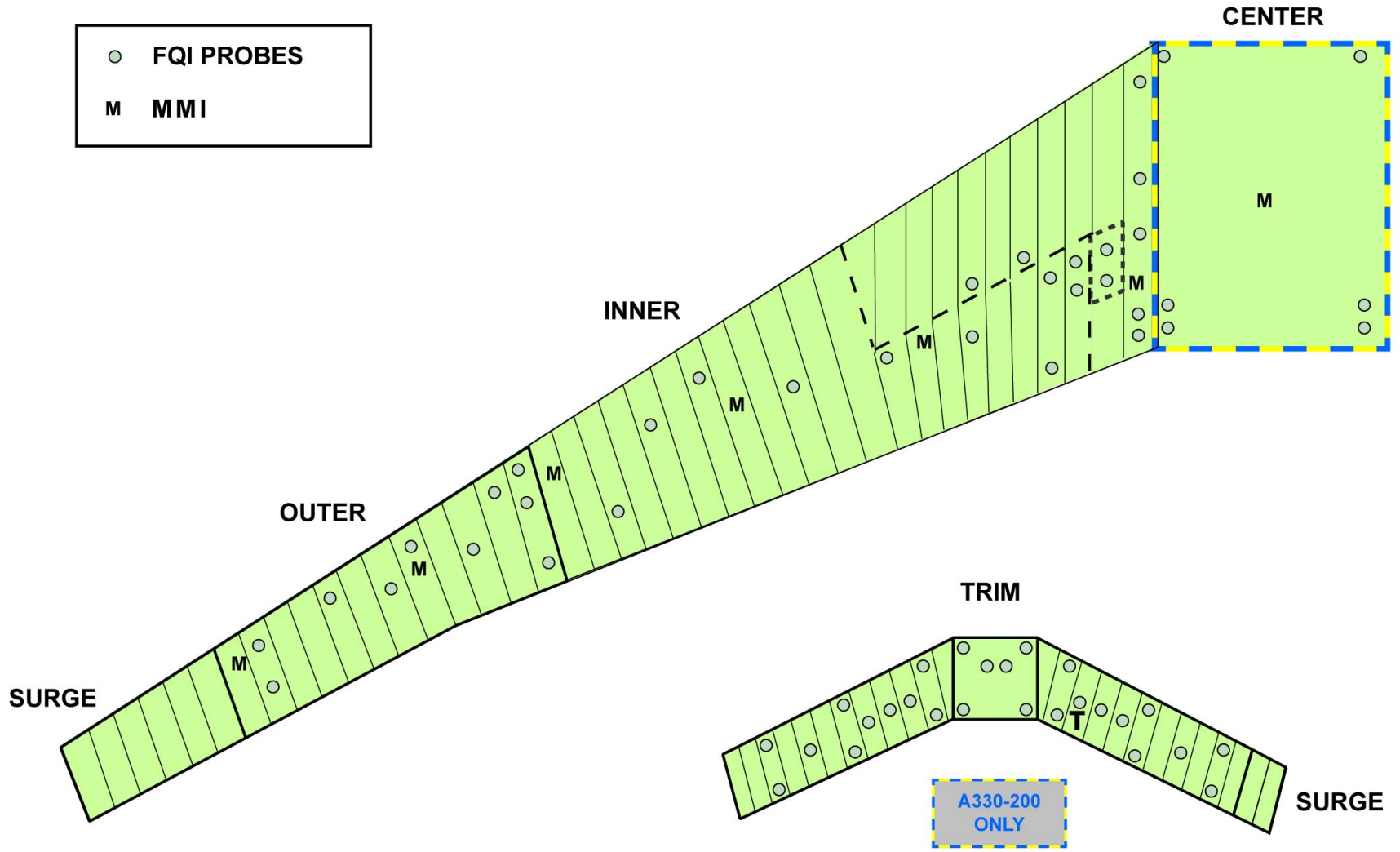

INDICATING - MANUAL MAGNETIC INDICATORS

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ENGINE FEED D/O (3)

GENERAL

The engine fuel pump system supplies the fuel from the inner tank collector cells to the engines. Each LP valve isolates the engine fuel feed supply at any shutdown or in case of emergency. The crossfeed system divides the engine feed system into two independent feed systems.

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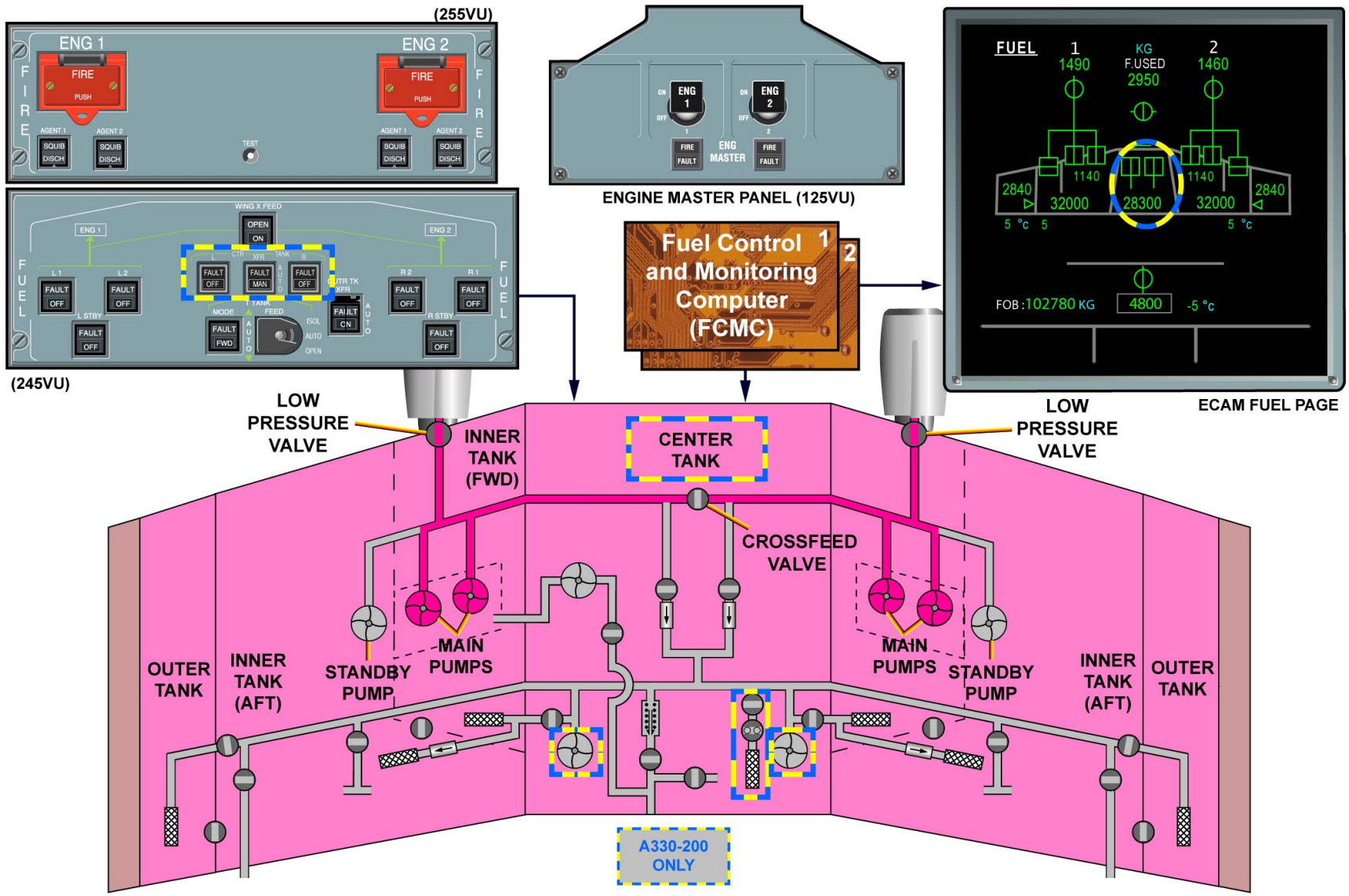
(255VU)
ENG 1
ENG 2
FIRE
PUSH
AGENT 1
AGENT 2
SQUIB DISCH
TEST
ENG 1
ENG 2
FIRE
FAULT
ENG MASTER
ENGINE MASTER PANEL (125VU)
FUEL
1
2
KG
F.USED
2950
1490
1460
1140
1140
2840
32000
28300
32000
2840
5 °c
5
5 °c
FOB :102780 KG
4800
-5 °c
ECAM FUEL PAGE
WING X FEED
OPEN
ON
FUEL
L 1
L 2
R 2
R 1
FAULT
OFF
FAULT
MAN
L STBY
R STBY
MODE
FEED
FWD
ISOL
AUTO
OPEN
CTR TK XFR
(245VU)
Fuel Control and Monitoring Computer (FCMC)
1
2
LOW PRESSURE VALVE
INNER TANK (FWD)
CENTER TANK
CROSSFEED VALVE
LOW PRESSURE VALVE
OUTER TANK
INNER TANK (AFT)
STANDBY PUMP
MAIN PUMPS
MAIN PUMPS
STANDBY PUMP
INNER TANK (AFT)
OUTER TANK
A330-200 ONLY

GENERAL

ENGINE FEED D/O (3)

DESCRIPTION

This topic describes the main components of the engine feed.

FUEL PUMPS

Installed in each collector cell are:
- a fuel pump canister and its related fuel pump element which together make the two main pumps,
- a fuel pump canister and its related fuel pump element which together make the standby pump,

The canister, attached to the wing bottom skin, makes the replacement of the fuel pump element possible when there is fuel in the collector cell.

Pumps and canisters are all assembled in the same way and are interchangeable. The centrifugal-type pump is driven by a 3-phase 115 VAC motor. The pumps get their fuel supply from the lowest part of the collector cell. When they are in operation, each pump has two outlets, one outlet for the engine feed pipe, and the other for jet pump.

CHECK VALVES

A check valve is installed in each pump canister outlet. When the fuel pumps are not in operation, the two check valves prevent a reverse flow either from the engine feed line or the jet pumps.

MAIN JET PUMPS

Also installed in each collector cell is a jet pump to keep the collector cell full of fuel.

The fuel supply from the pump through the jet pump nozzle causes suction. This suction causes fuel to be moved from the inner cell to the collector cell. The rate of flow makes sure that the collector cell is kept full of lightly pressurized fuel to prevent fuel pump cavitations during negative 'G' load conditions.

STANDBY JET PUMP

A Water Scavenge Jet Pump is installed in rib 3 area of the wing in the vicinity of the standby fuel pump. This Jet Pump has an induced flow line to the rib bay 3-4 tank sump and receives motive flow from the Standby Pump. Water accumulated in rib bay 3-4 will then be scavenged as long as the Standby Pump operates.

PRESSURE SWITCHES

Each fuel pump has an output monitoring LP switch installed on the rear face of the wing spar. It operates between 6 and 8 psi depending on pressure increase or decrease.

THERMAL RELIEF VALVES

To prevent excessive pressure a thermal relief valve is installed on each engine feed line and installed near the main pump of engine feed outlet in the collector cell. In case of fuel temperature increase and engine not running, this thermal relief valve will prevent fuel pipe damage due to fuel expansion between closed LP and crossfeed valve. This valve is of the ball and spring type.

AIR RELEASE VALVES

Air release valves release air caught in the engine fuel feed line and crossfeed line. There is one air release valve located near each LP valve; another one is installed on the crossfeed line in the center tank. They are used to decrease the quantity of air which could go to an engine during engine feed or crossfeed operation. They are of the float type.

LP VALVES AND ACTUATORS

Each LP valve and associated actuator isolates its related engine from the engine fuel feed-line. The LP valve is installed on the inner tank wing front spar in the engine feed line. The interface between the actuator and the LP valve is a valve spindle that goes through the front

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spar. When the actuator is energized, it moves the LP valve to the open or closed position. The LP valves are of the ball type. The actuators include 2 electrical motors and a visual position indicator.

CROSSFEED VALVE AND ACTUATORS

The crossfeed valves, of the ball-valve type, make the interconnection of engine feed systems. The crossfeed valve is operated with a twin motor actuator. It is installed in the center fuselage area or in the center tank for the A330-200 system. The actuator is mounted on the rear spar and has a visual indicator.

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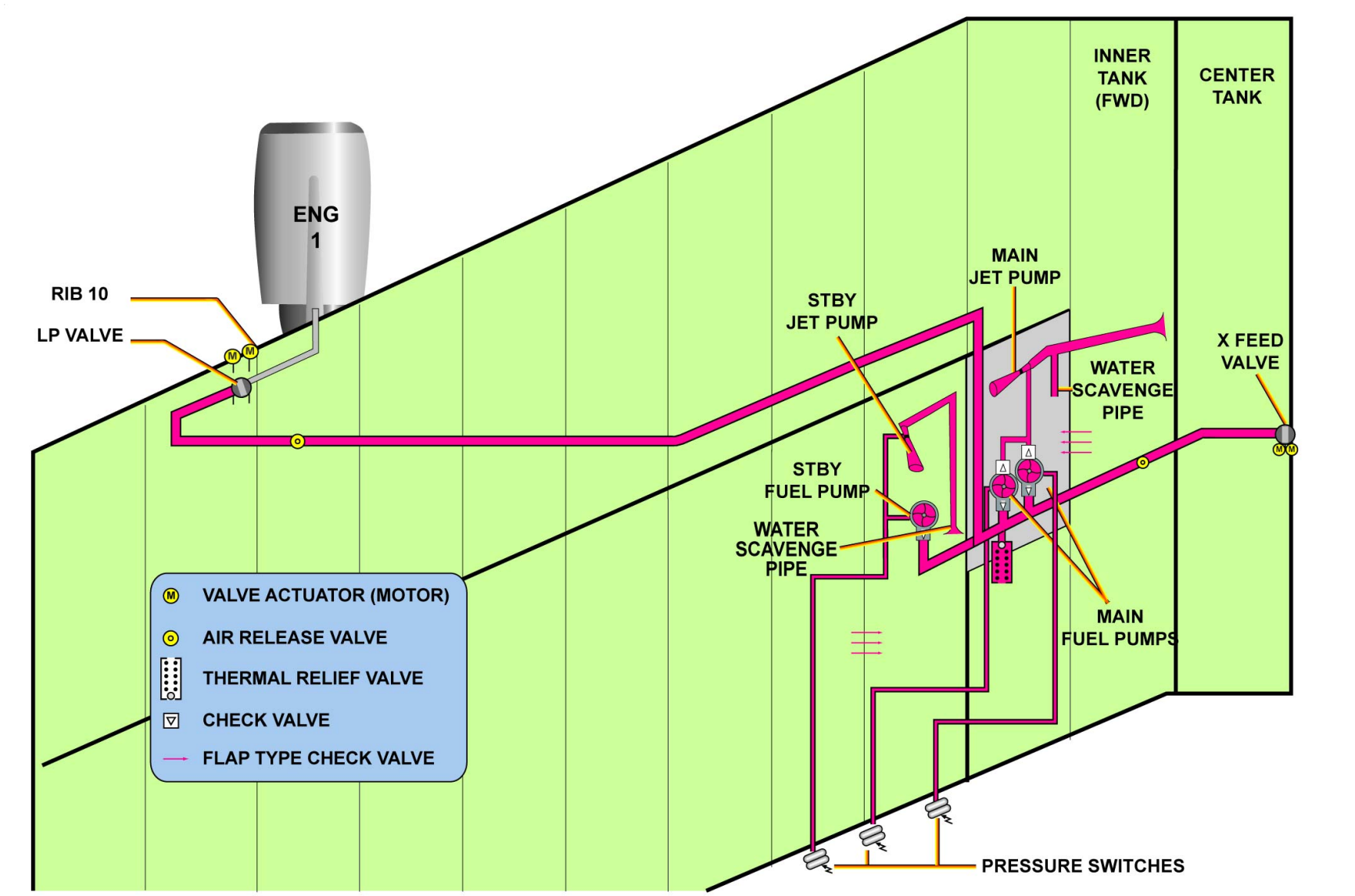

DESCRIPTION - FUEL PUMPS ... CROSSFEED VALVE AND ACTUATORS

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ENGINE FEED D/O (3)

OPERATION

This topic describes the main operation of the engine feed. As the engine feed systems are almost the same for each engine, only the operation of the left engine feed system is given here.

ENGINE FEED OPERATION

The main fuel pump system is manually controlled from the fuel panel through A/C relay logic. For the system to operate it is necessary to:
- energize the 115 VAC bus and the 28 VDC bus,
- close the main and standby fuel pump C/Bs.

Main and standby power supplies are from different sources.
The main and standby pumps P/BSWs are usually set to ON together. The main pumps then operate continuously. The standby pump only operates when the main pumps become defective or are set to OFF.
When the two main pumps are in operation, their pressure switches provide a ground for the STBY FUEL PUMP AUTO CTL 1. Then the contactor connects a 115 VAC supply to energize the main fuel pumps. If a main fuel pump fails or is set to OFF, the pressure from the pump decreases. When the pressure is less than 0.41 bar (6 psi) its pressure switch removes the ground to the STBY FUEL PUMP AUTO CTL 1 and supply the standby fuel pump contactor. Then the standby fuel pump supply the engine.
An improved water scavenge function in the rib bay 3-4 area (Standby Pump location) is ensured by the Standby Fuel Jet Pump fed by the Standby Pump operation.
This function is controlled automatically by the FCMC (via relay control logic not shown on the slide) by operating automatically the Standby Pump when :
- aircraft is on the ground (LGCIU signal),
- both main fuel pumps have been selected on the corresponding wing
- engines are confirmed in IDLE thrust after engine start procedure (EIVMU signal).

Water accumulated in rib bay 3-4 will then be scavenged and the FCMC will stop automatically the Standby Pump after Take Off (aircraft in FLT). This water scavenge function will not be re-engaged by the FCMC during the rest of the flight and it will not interfere the normal pump control system.
The Flight Control and Monitoring Computers (FCMCs) receive discretes from the P/BSWs, from the pressure switches and from the fuel pump contactors. This data is used for system status monitoring, fault reporting and indication through the ECAM system.

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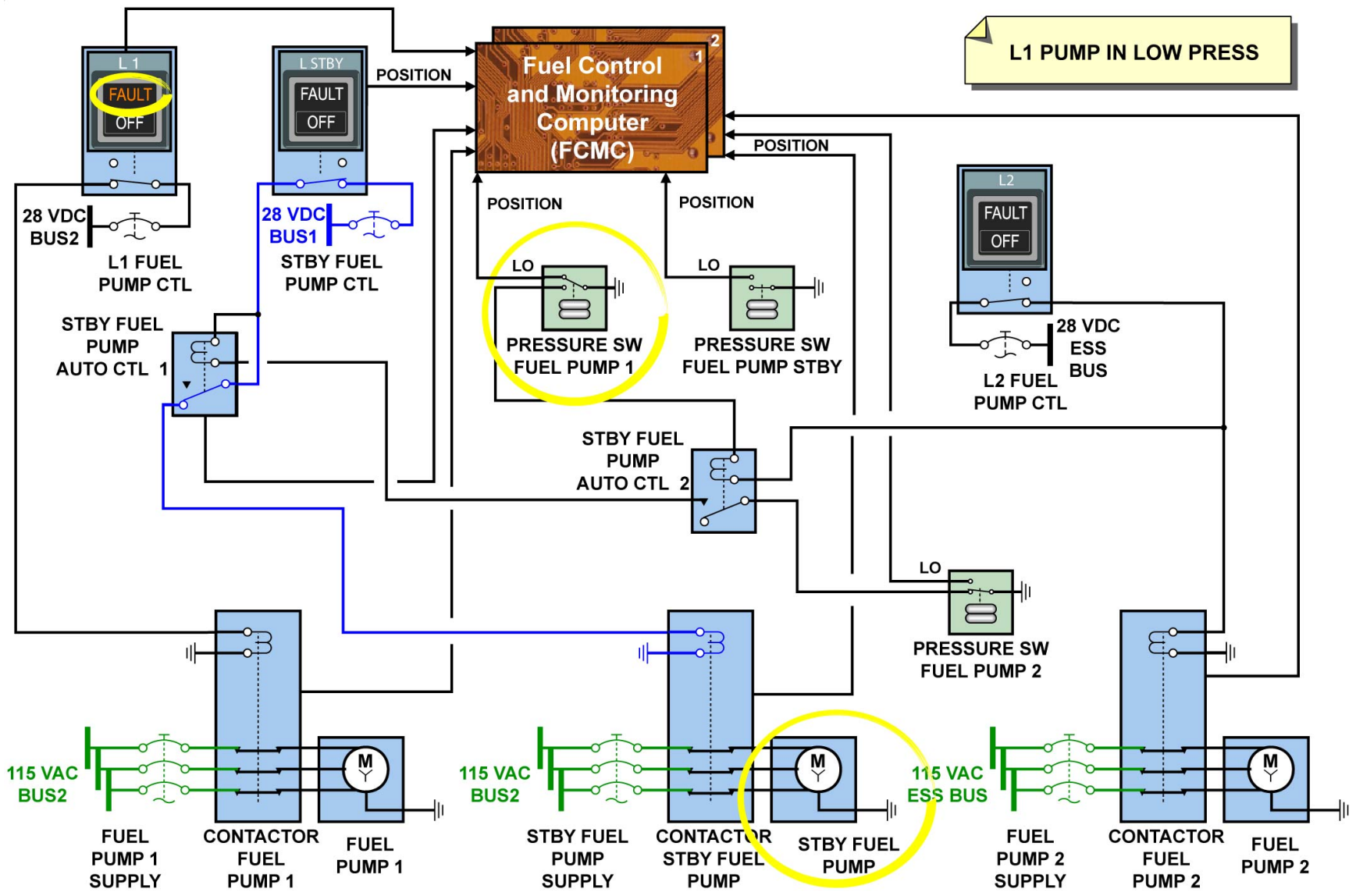

OPERATION - ENGINE FEED OPERATION

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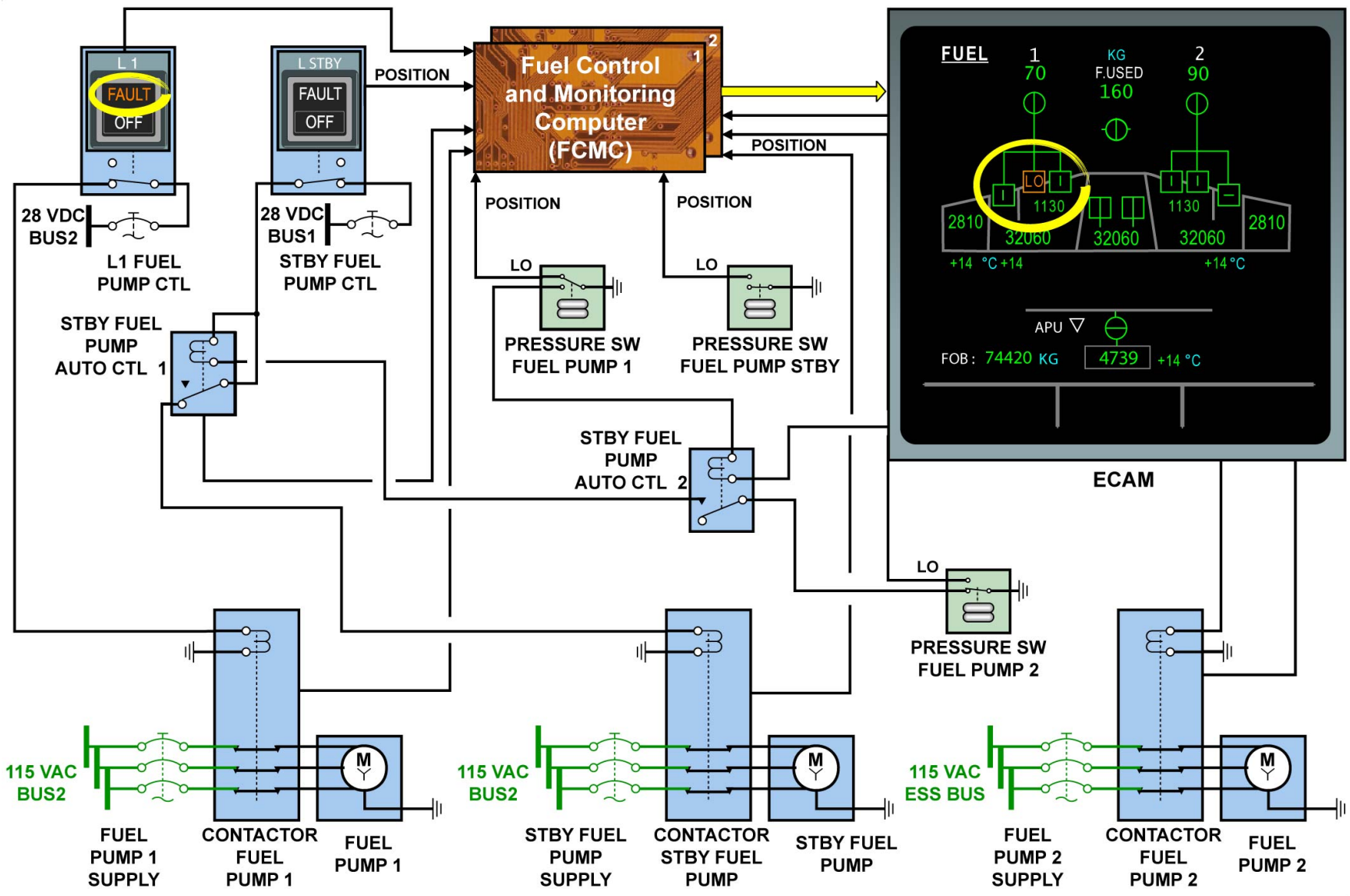

OPERATION - ENGINE FEED OPERATION

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ENGINE FEED D/O (3)

OPERATION (continued)

ENGINE FEED ABNORMAL OPERATION

If a main pump becomes defective or is set to OFF, the fuel pressure from the pump decreases. When the pressure is 0.41 bar (6 psi) the fuel pump pressure switch removes the ground to the standby fuel pump automatic-control 1 relay. The relay connects a 28 VDC supply to the standby fuel pump control contactor which connects a 115 VAC supply to energize the standby pump. Following the failure detection, an ECAM message is triggered and the FUEL SD page is displayed.
If the main and standby pumps do not operate, engine gravity feed is still available through the pumps. The engine causes a suction that pulls fuel through the fuel pump inlet, through the outlet check valve and into the engine feed line.
In case of emergency electrical configuration, only the left main pump 2 is electrically supplied from the Constant Speed Motor/Generator (CSM/G), in order to restart or supply fuel to any of the two engines.
If the left main pump 2 is set to OFF or FAULT, the right main pump 2 will operate. If the LAND RECOVERY P/BSW is pushed, the running pump stops automatically and the two engines are then gravity fed.

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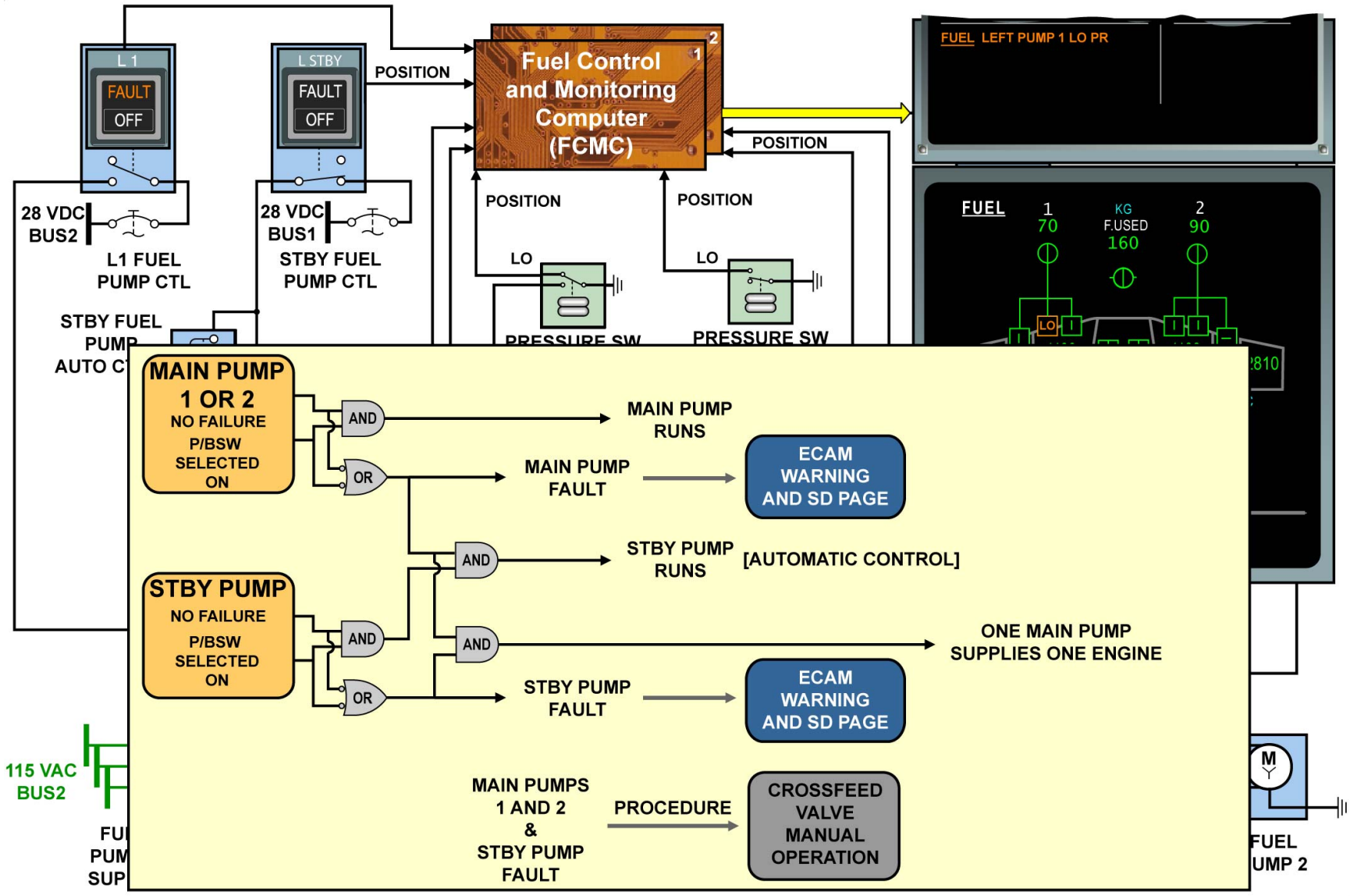

OPERATION - ENGINE FEED ABNORMAL OPERATION

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ENGINE FEED D/O (3)

OPERATION (continued)

LP VALVE OPERATION

There is one LP valve for each engine, and each engine has an equivalent circuit. Thus as each LP valve circuit is the same, only the operation of the No. 1 engine circuit is described here. Each actuator has two motors, which get their power supply from different sources:
- the 28 VDC ESS bus supplies motor 1,
- the 28 VDC bus 2 supplies motor 2.

The engine LP fuel shut-off system is controlled manually.
When the ENG 1 FIRE P/BSW is in and guarded, the ENG 1 MASTER switch selection to ON disconnect the 28VDC supply from the master switch slave ENG 1 relay. The relay de-energizes and connects a 28 VDC supply (through the ENG 1 FIRE P/BSW) to the LP valve actuator. The actuator then opens the LP valve.
When the No. 1 ENG MASTER switch is set to OFF, it connects a 28 VDC supply to the relay. The relay energizes and connects a 28 VDC supply through the ENG 1 FIRE P/BSW to the LP valve actuator. The actuator then closes the LP valve.

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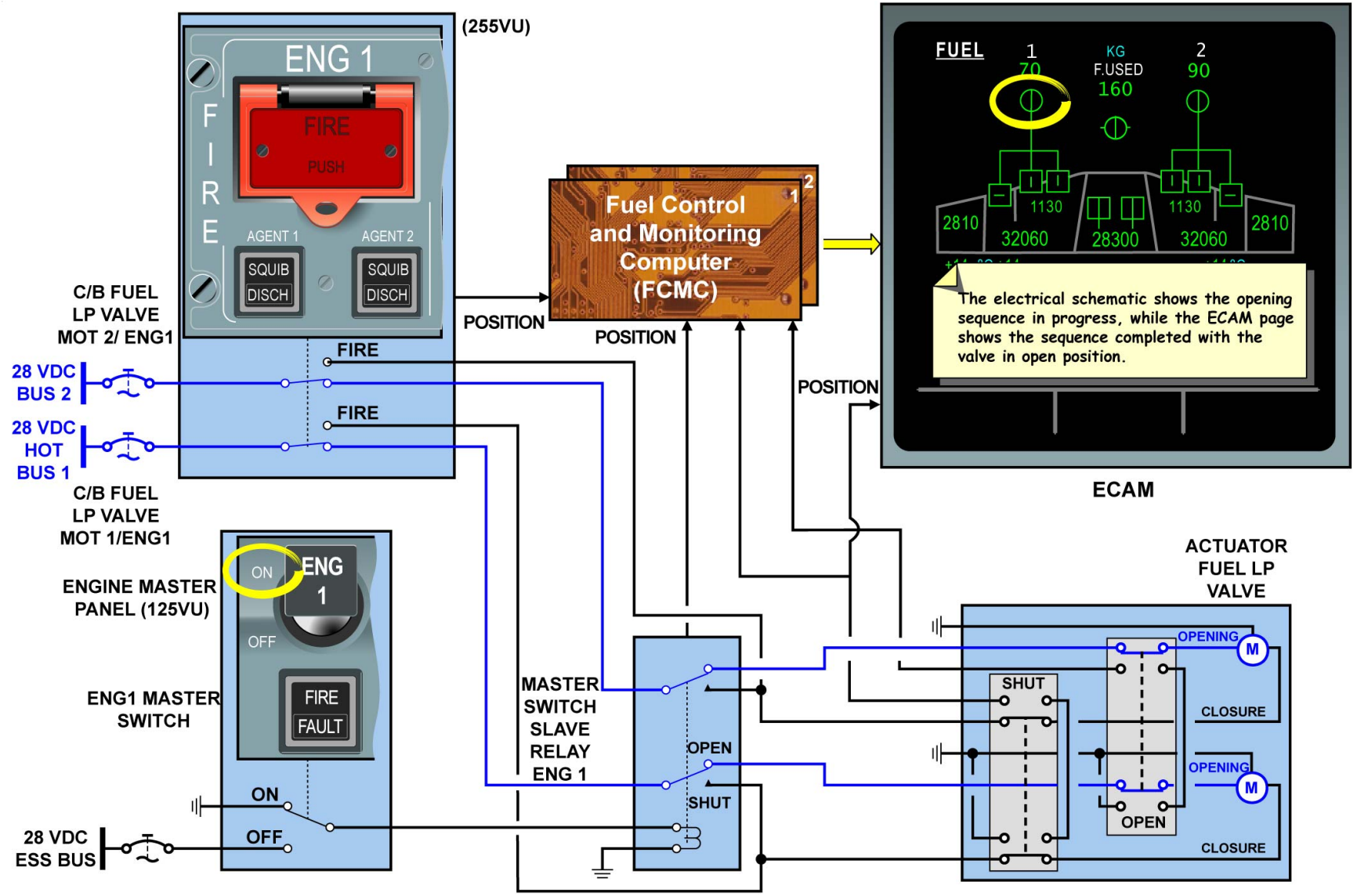

OPERATION - LP VALVE OPERATION

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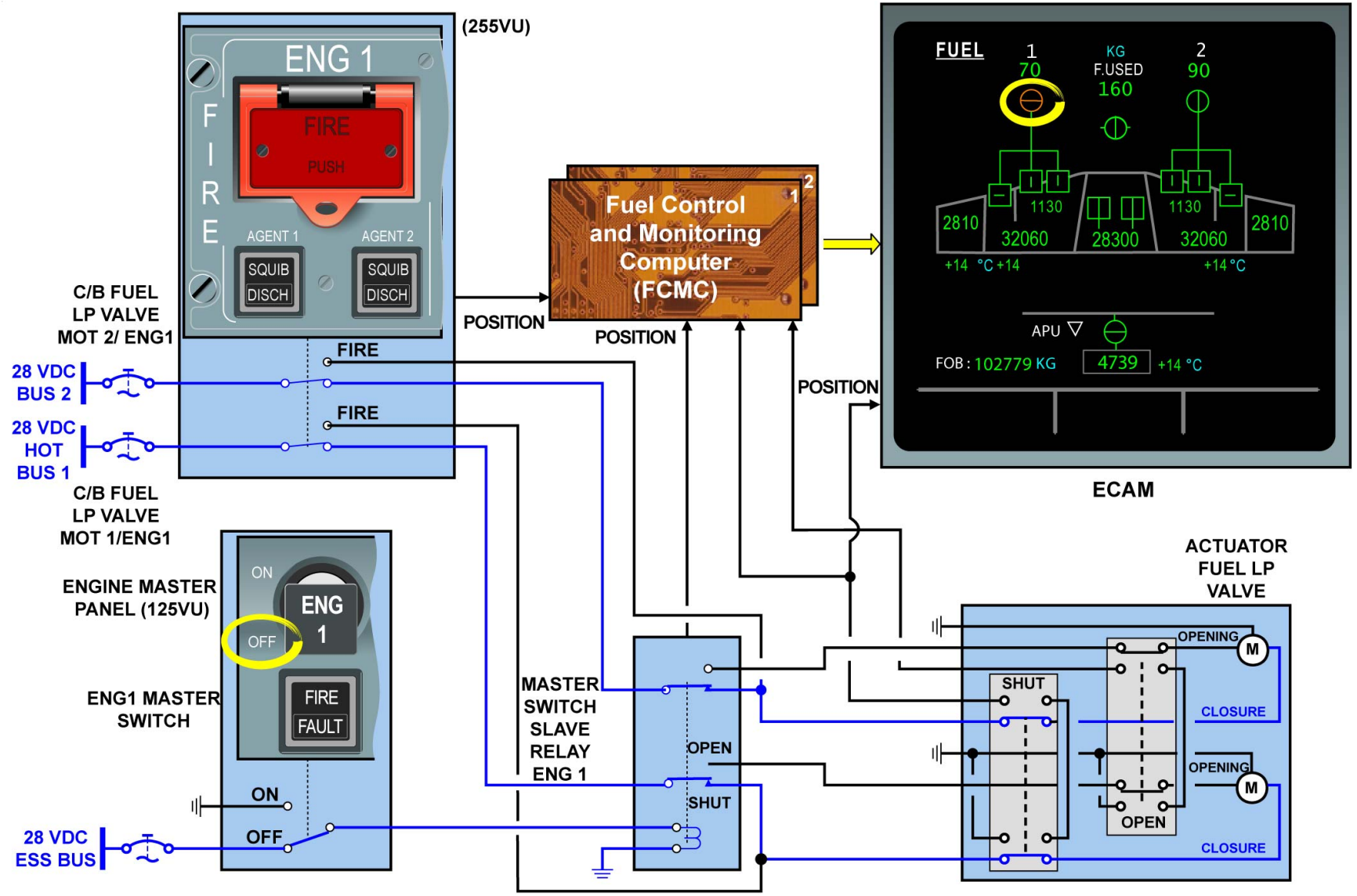

OPERATION - LP VALVE OPERATION

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ENGINE FEED D/O (3)

OPERATION (continued)

LP VALVE OPERATION IN CASE OF ENGINE FIRE

If the ENG 1 FIRE P/BSW is released when the master switch is on:
- it disconnects the 28 VDC supply from the 'open' side of the actuator,
- it connects a 28 VDC supply to the 'close' side of the actuator, the LP valve moves to the closed position.

Operation of the ENG 1 FIRE P/BSW always overrides an ON selection and closes the valve.

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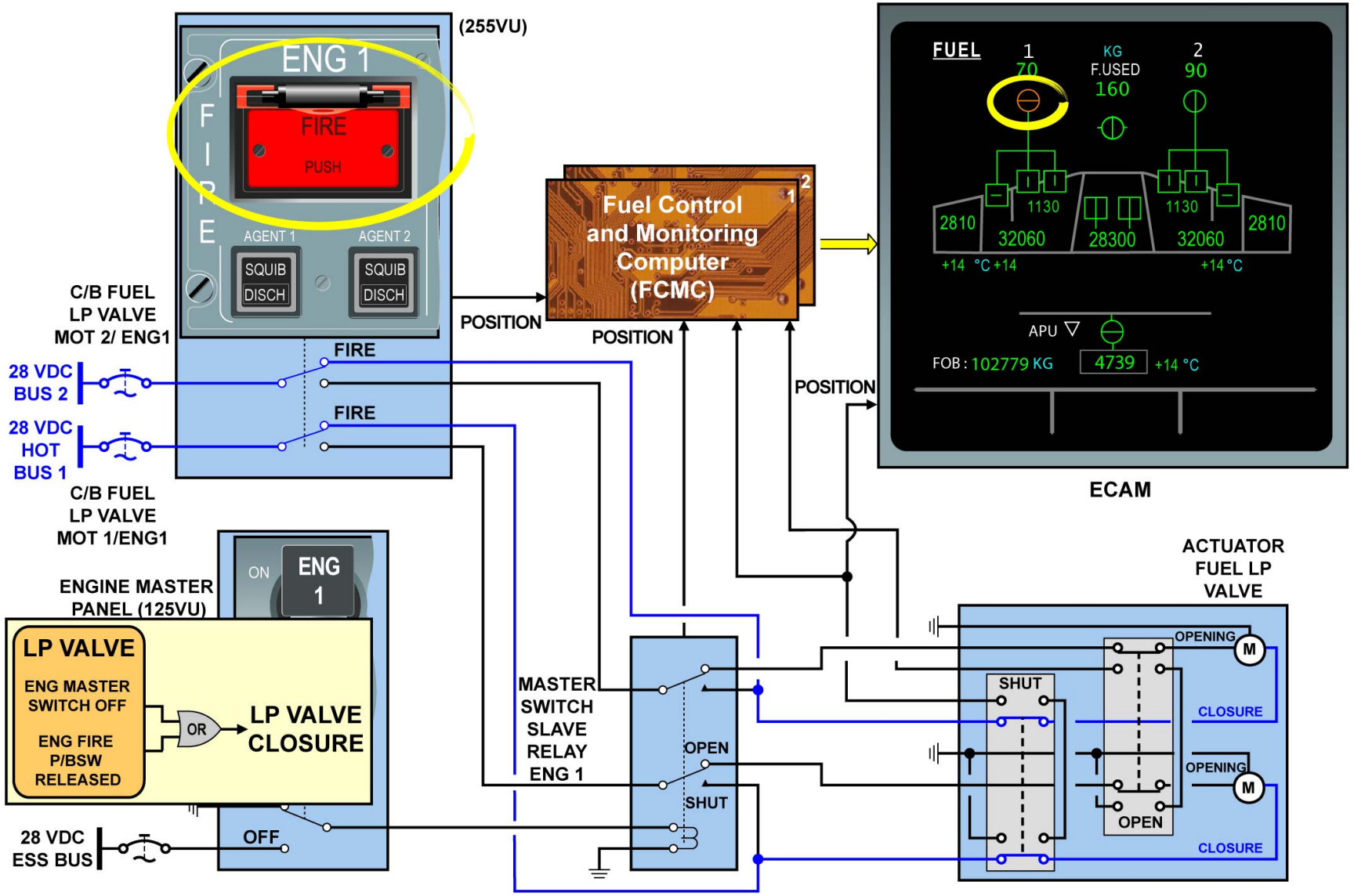

OPERATION - LP VALVE OPERATION IN CASE OF ENGINE FIRE

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ENGINE FEED D/O (3)

OPERATION (continued)

MANUAL CROSSFEED OPERATION

Following an ECAM warning, related to an engine pump system failure, manual crossfeed valve operation is requested by the procedure. The crossfeed valve has a dual motor actuator:
- motor 1 is supplied from 28 VDC ESS bus,
- motor 2 is supplied from 28 VDC NORM bus.

When the X FEED P/BSW is pushed in:
- the ON white light comes on in the P/B,
- the 28 VDC supply energizes the two electrical motors of the actuator,
- the crossfeed valve turns to the open position,
- the green OPEN light comes on, on the P/B,
- the crossfeed valve signal is shown open on the ECAM FUEL page.

When the same P/BSW is released out:
- on the P/B the ON and OPEN lights go off,
- the 28 VDC supply energizes the two electrical motors of the actuator,
- the crossfeed valve turns to the closed position,
- the crossfeed valve is shown closed on the ECAM FUEL.

The crossfeed valve P/B, X FEED CTL relay and actuator feedback discretes are sent to the FCMCs for indication, system status and fault reporting purposes.

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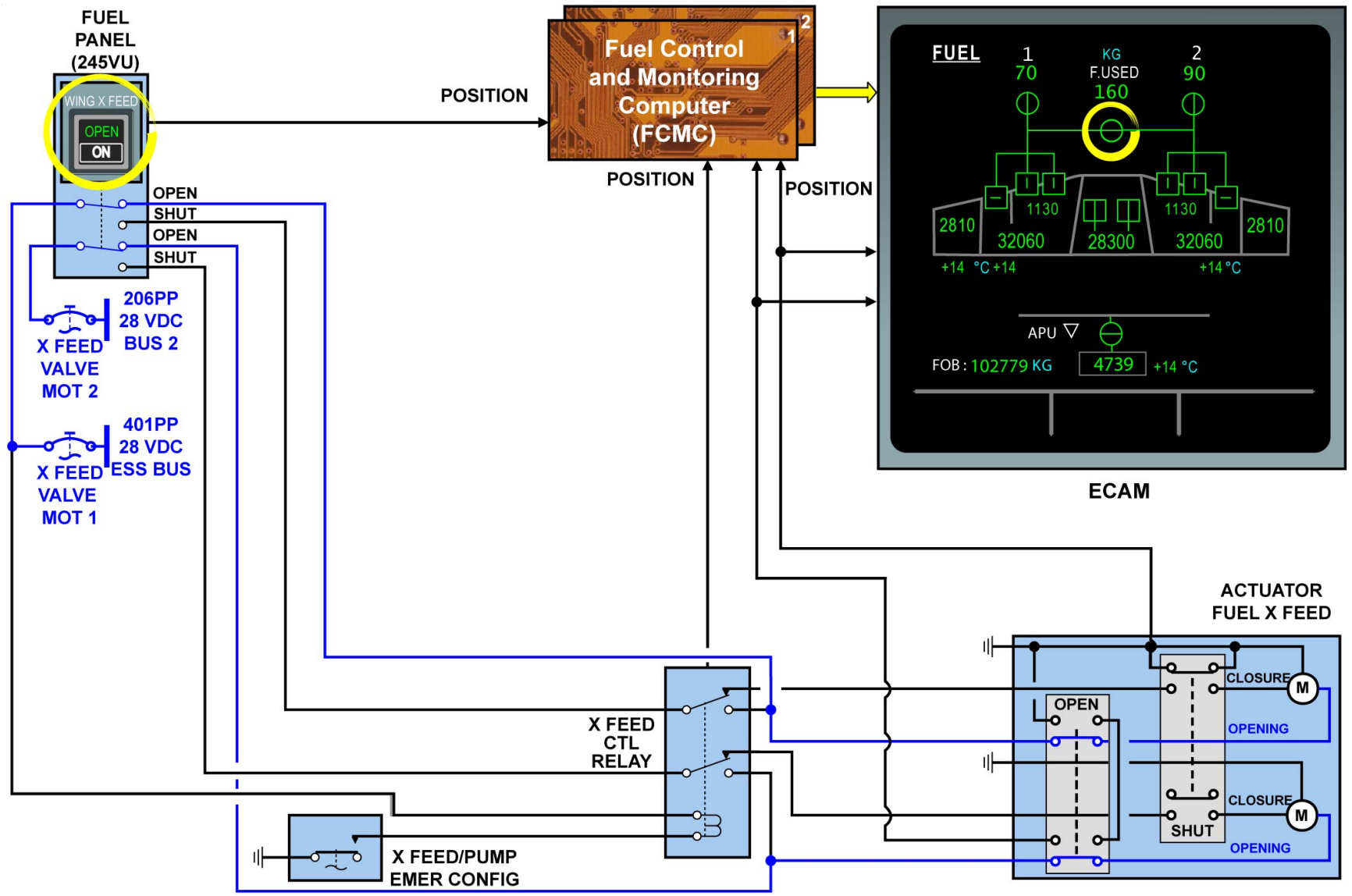

OPERATION - MANUAL CROSSFEED OPERATION

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ENGINE FEED D/O (3)

OPERATION (continued)

AUTOMATIC CROSSFEED OPERATION IN CASE OF EMERGENCY ELECTRICAL CONFIGURATION

The crossfeed valve opens automatically by relay logic control when the A/C is in an emergency electrical configuration, in order to supply any engine. The crossfeed valve can be also opened automatically while operating the jettison system (if installed).
In an emergency electrical configuration, only LH MAIN PUMP 2 (inboard pump) remains powered ON. RH MAIN PUMP 2 (inboard pump) remains in hot standby. It will be energized by relay logic if LH MAIN PUMP 2 is in LOW PRESS or if LH MAIN PUMP 2 PB/SW is selected OFF.
All the others pumps will be de-energized to save electrical power onboard.
During final approach in an emergency electrical configuration, flight crew will have to select the LAND RECOVERY PB/SW. This action will leave the crossfeed valve opened and de-energize all fuel pumps onboard (engine gravity feeding) until landing.

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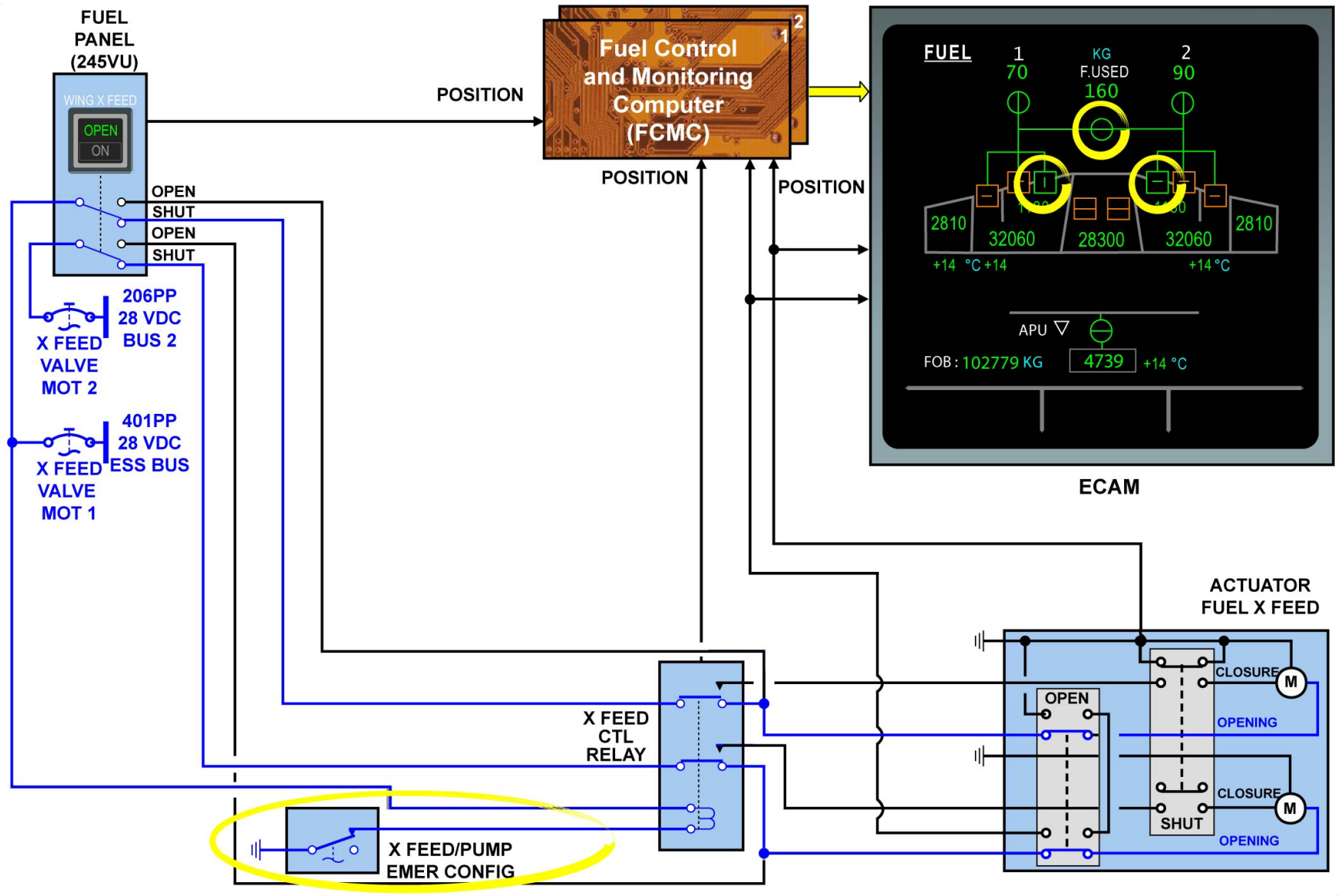

OPERATION - AUTOMATIC CROSSFEED OPERATION IN CASE OF EMERGENCY ELECTRICAL CONFIGURATION

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APU FEED D/O (3)

GENERAL

The APU fuel pump system supplies the necessary fuel to operate the APU in all operating conditions. The fuel is supplied to the APU from the LH inner tank through the trim tank transfer line with the FWD APU pump when the trim tank fuel transfer system does not operate. The aft APU pump runs when the trim tank fuel transfer system operates. A fuel isolation valve and an LP fuel shut-off valve control the fuel flow to the APU.

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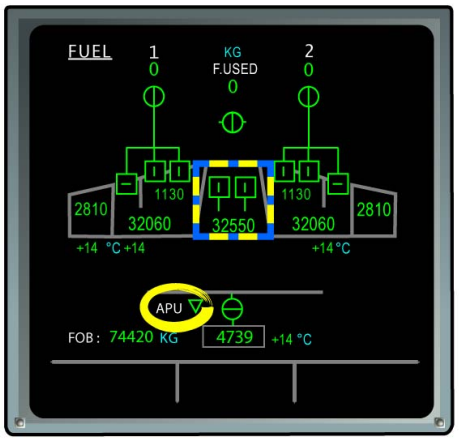
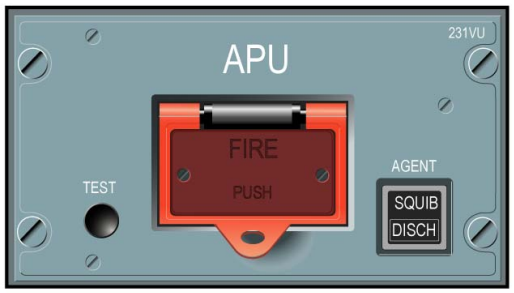
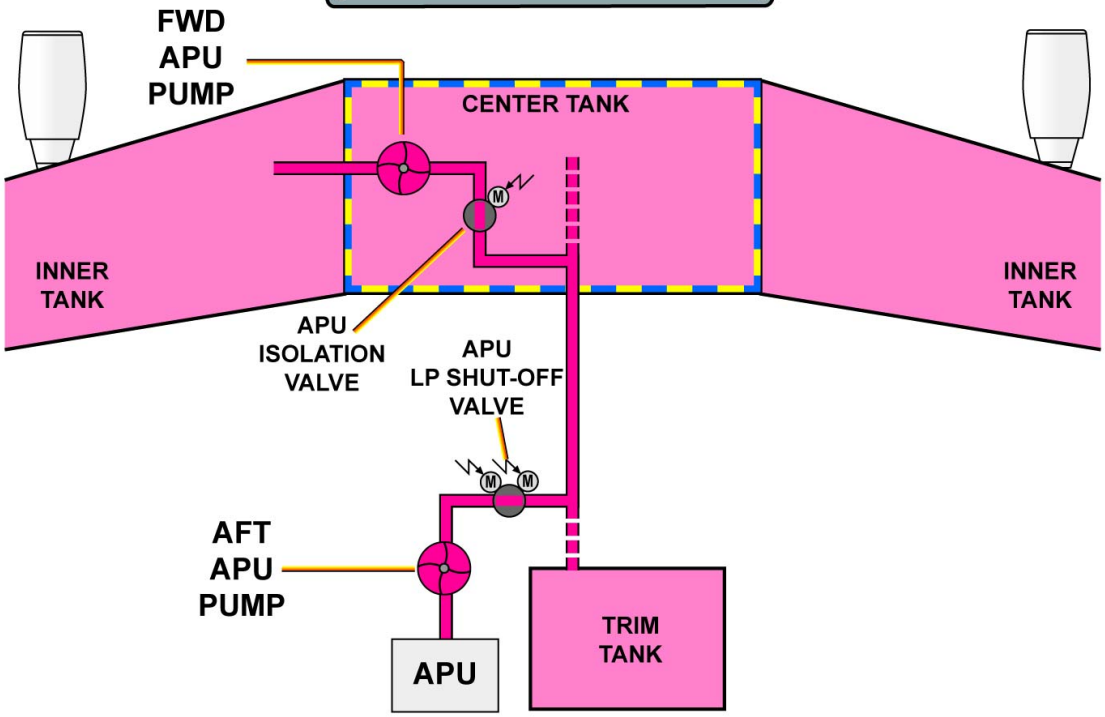
ECAM FUEL PAGE







A330-200 ONLY

GENERAL

G9409341 - GAUT0T0 - FM28D5000000003

APU FEED D/O (3)

DESCRIPTION

Here is a detailed description of the APU feed system.

FUEL FEED LINE

A double shrouded tube system extends along the trim transfer line and the APU fuel line. A venting outlet connected to the fuselage skin next to frame 95, allows any leaking fuel to drain at the lowest end through the drain mast. There is also the APU fuel line vent and drain valve, between APU and aft APU pump.

APU FUEL FEED PUMPS

The FWD APU fuel feed pump is installed on the rear spar of the wing center section. The pump is of the centrifugal type and is driven by a 115V AC single-phase motor, supplied from the NORM BUS. The pump can supply 288 kg/h (635 lbs/h) at a pressure increase of 1.2 bar (17.4 PSI). The operation of the pump is fully automatic. The aft APU fuel feed pump is installed in the THS compartment. It is a vane type pump with a single-phase 115V AC motor, supplied from the STATIC INV BUS A. The pump is self-priming with sufficient capacity to cope with released air.

FUEL/AIR SEPARATOR

The fuel/air separator is installed in the THS compartment, at the junction between the APU fuel feed line and the trim tank. It keeps sufficient fuel for APU operation if air enters the transfer line.

PRESSURE SWITCH

The fuel pressure switch is installed on the fuel/air separator. It closes when the absolute pressure in the fuel/air separator is less than 22 PSI. Consequently the aft APU pump is energized through a relay logic.

VENT P/BSW

At the FWD firewall of the APU compartment is a vent P/BSW. It is used for the line maintenance to examine or to refuel the APU fuel system.

APU FUEL ISOLATION VALVE AND ACTUATOR

The fuel isolation valve is installed in the wing center section rear spar and controls fuel flow from the LH inner tank to the trim tank fuel transfer line. The valve position is monitored by the FCMCs.

APU LP SHUT-OFF VALVE

The APU LP shut-off valve is installed in the APU fuel line between the fuel/air separator and the aft fuel feed pump. The valve position is monitored by the FCMCs.

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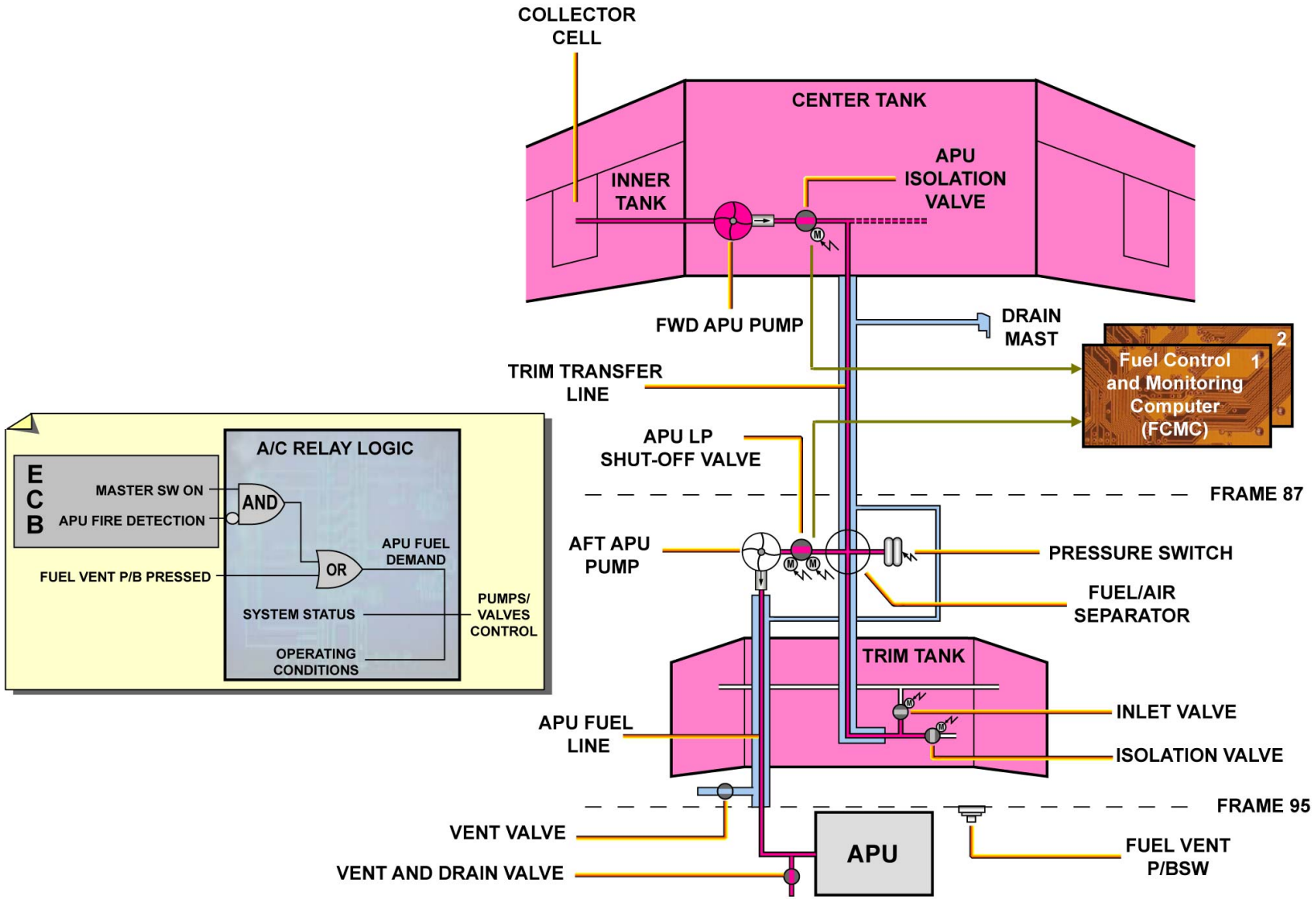

DESCRIPTION - FUEL FEED LINE ... APU LP SHUT-OFF VALVE

G9409341 - GAUT0T0 - FM28D5000000003

APU FEED D/O (3)

OPERATION

The following information is a detailed description of the APU feed normal operation, shutdown operation, emergency shut-off operation, and the fuel line purging.

APU FEED NORMAL OPERATION

When the APU operates, the Electronic Control Box (ECB) opens the LP fuel shut-off valve and the isolation valve. It energizes the forward APU pump, which supplies the fuel to the APU fuel system. To check the operation of the aft APU pump during APU start sequence, a 2-minutes time delay relay prevents the operation of the forward APU pump, resulting in a low pressure condition in the line and the automatic switching to the aft APU pump through a relay logic.
If the pressure switch detects a low-pressure condition, it starts the aft pump which then supplies the fuel from the fuel/air separator to the APU.

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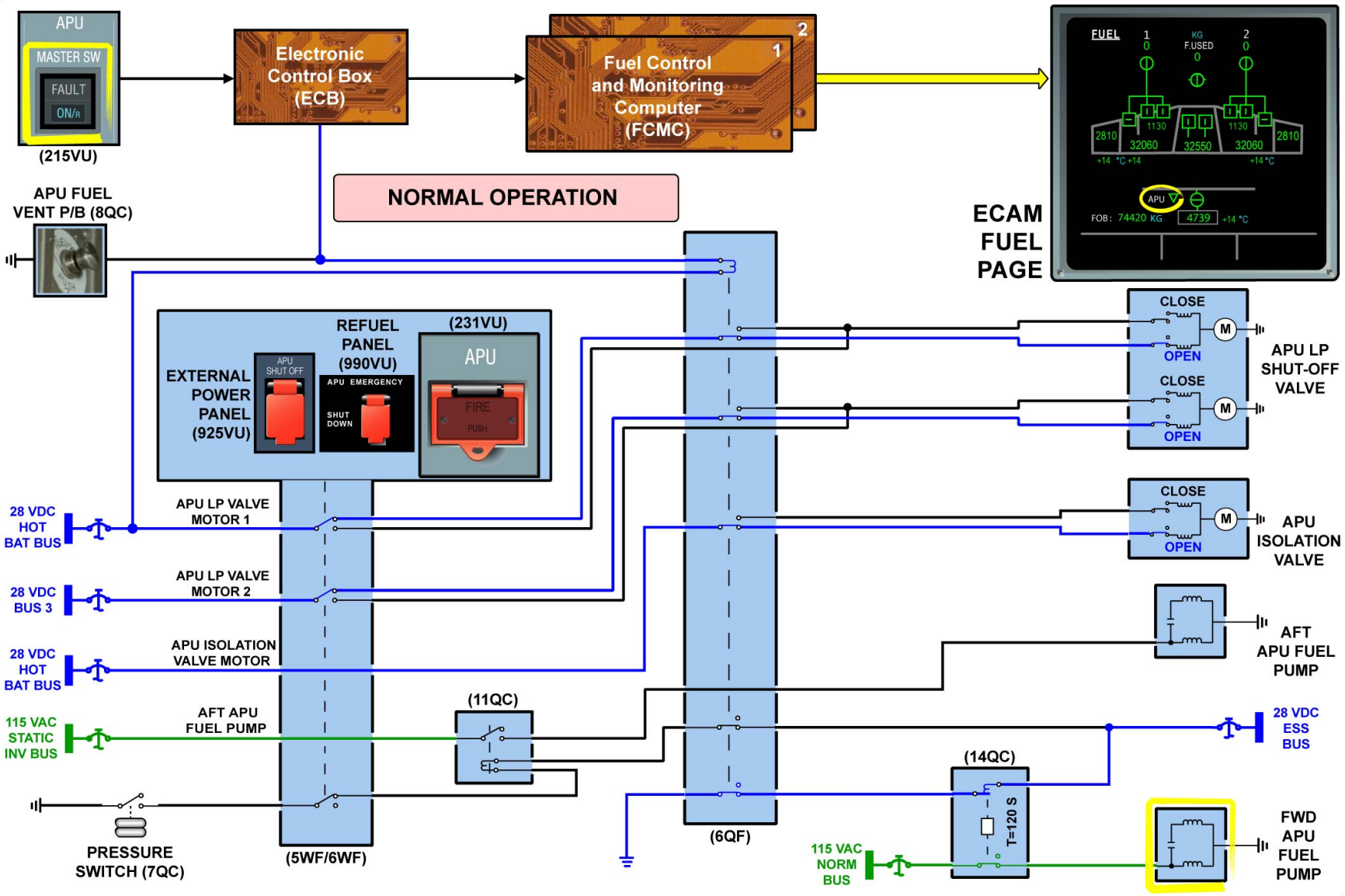

OPERATION - APU FEED NORMAL OPERATION

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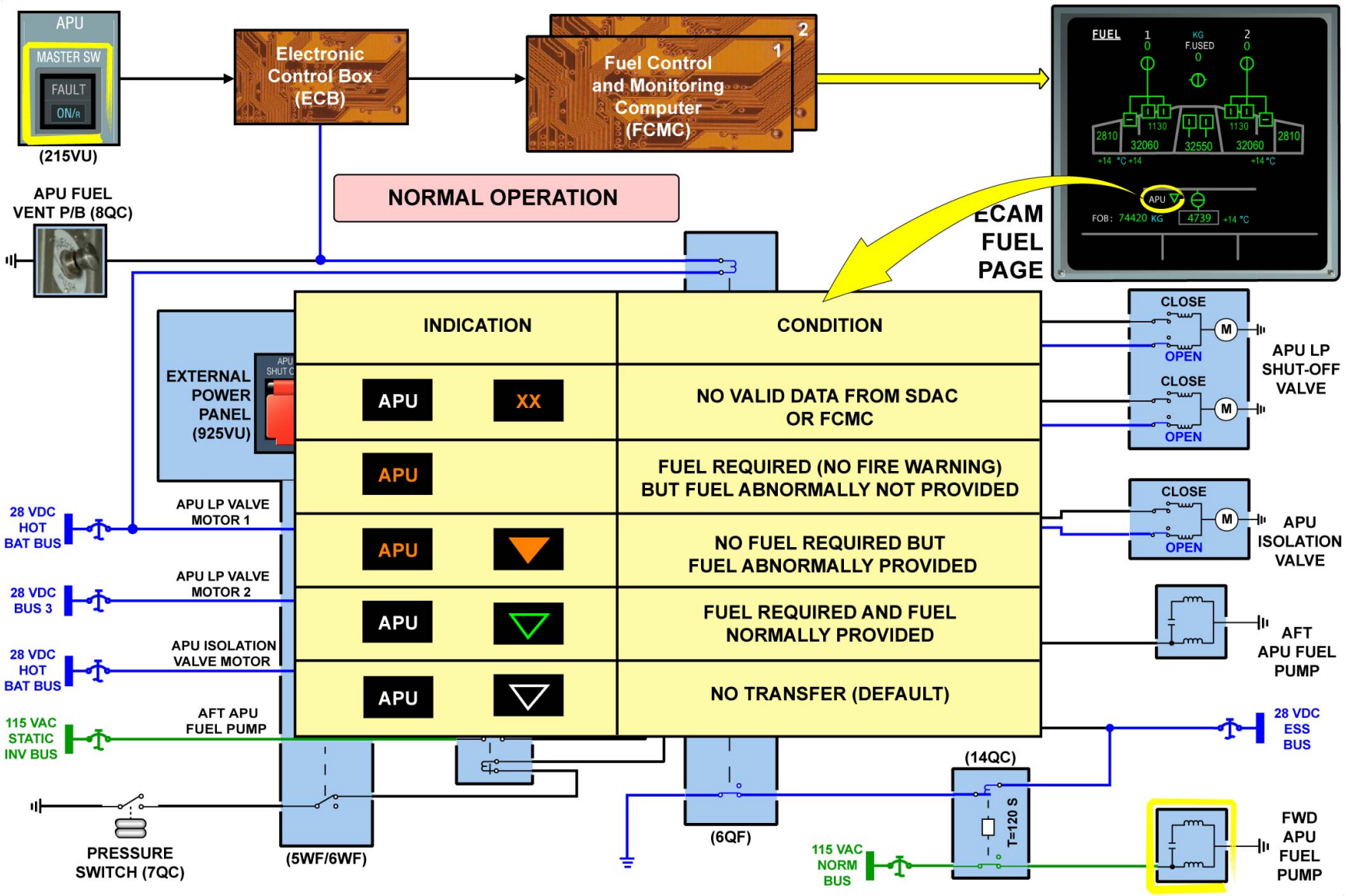

OPERATION - APU FEED NORMAL OPERATION

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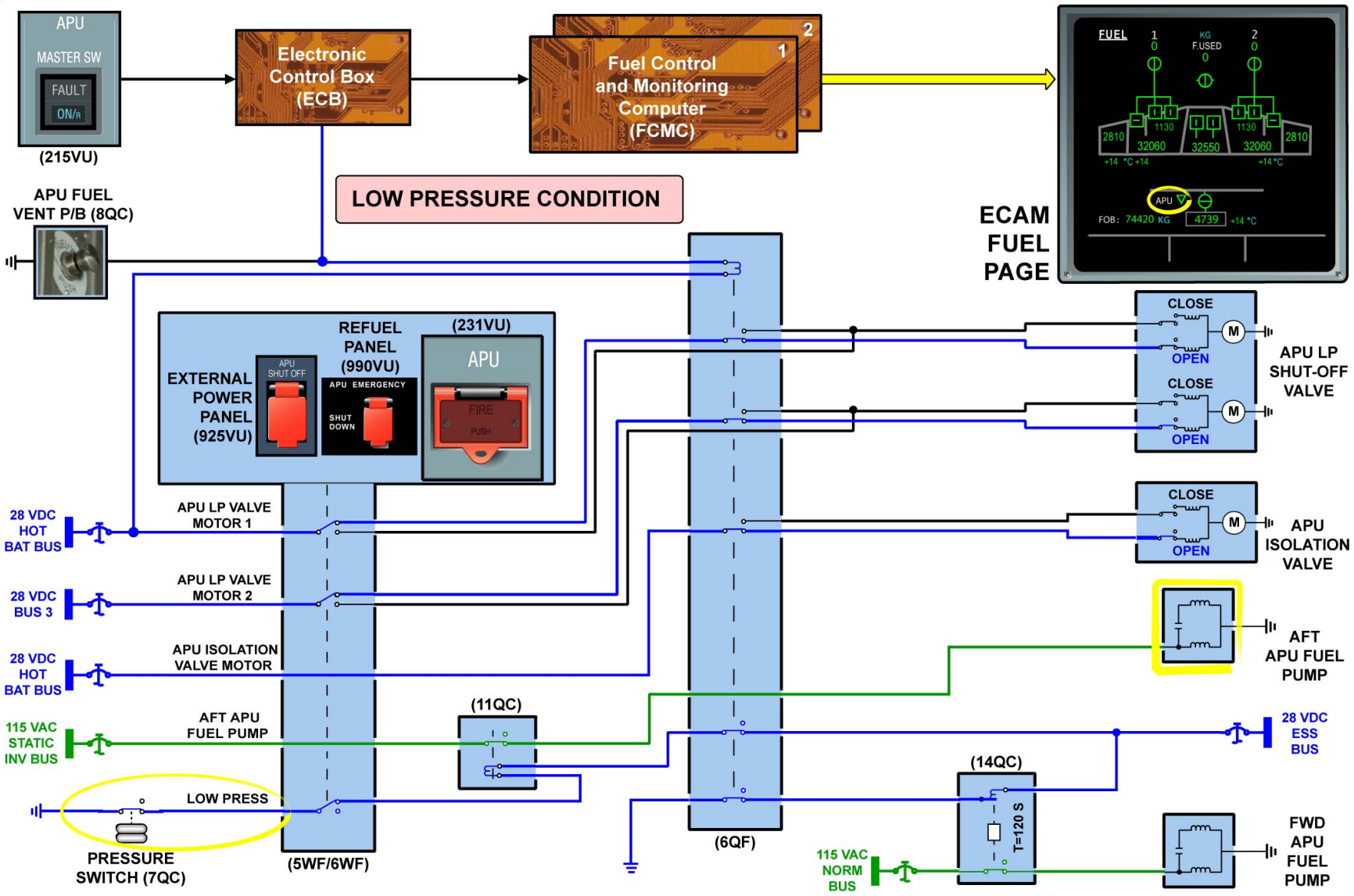

OPERATION - APU FEED NORMAL OPERATION

APU FEED D/O (3)

OPERATION (continued)

APU SHUTDOWN OPERATION

When the APU shuts down, the ECB closes the APU fuel isolation valve and APU LP fuel shut-off valve and de-energizes the FWD and aft APU fuel pumps.

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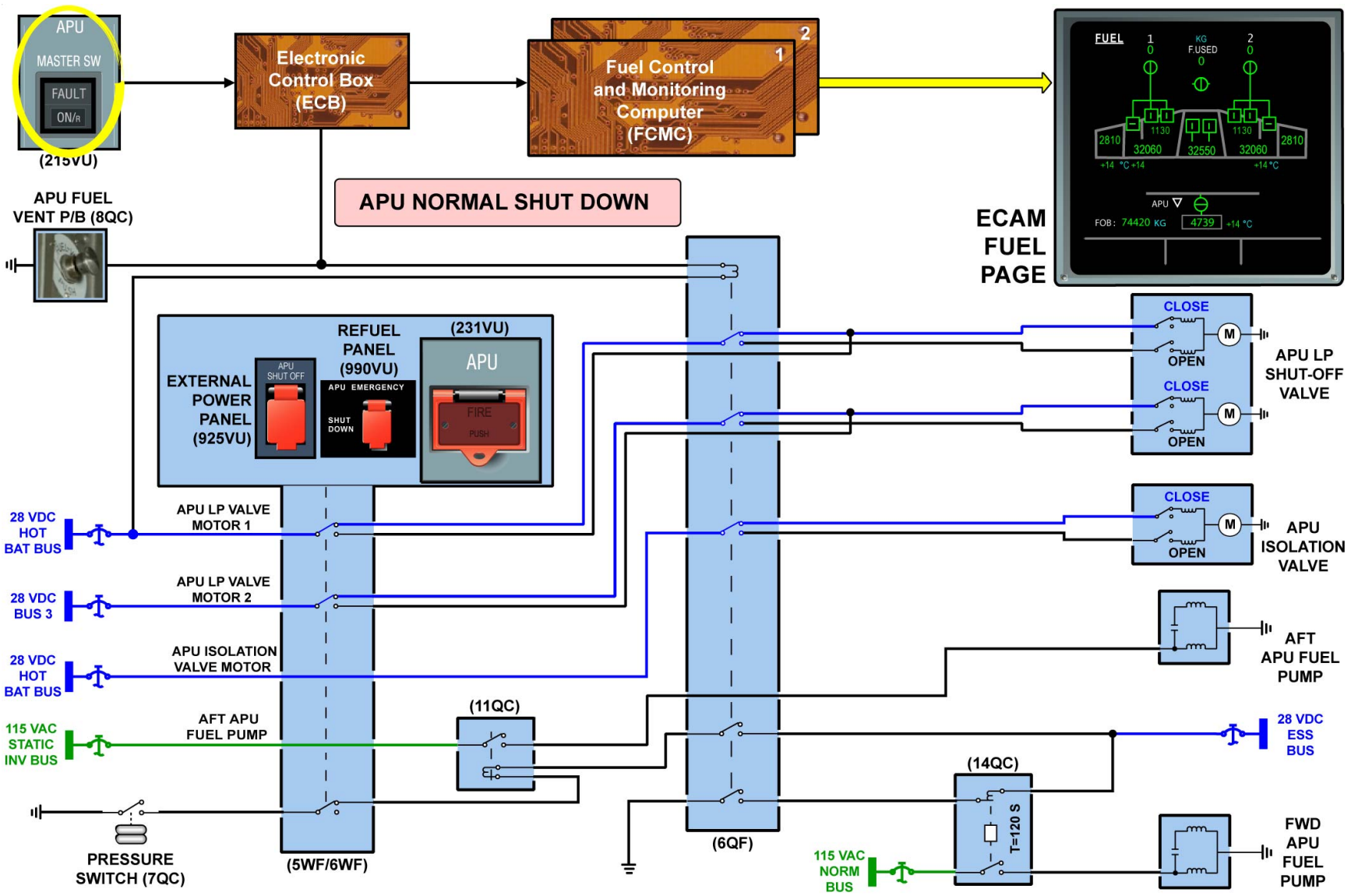

OPERATION - APU SHUTDOWN OPERATION

APU FEED D/O (3)

OPERATION (continued)

APU EMERGENCY SHUT-OFF OPERATION

A manual emergency APU fuel supply isolation will be done if:
- the APU FIRE P/B is released following an APU fire procedure,
- the APU EMERGENCY SHUT-DOWN P/B is pressed on the refuel/defuel panel on ground,
- the APU SHUT-OFF P/B is pressed on the external power panel on ground.

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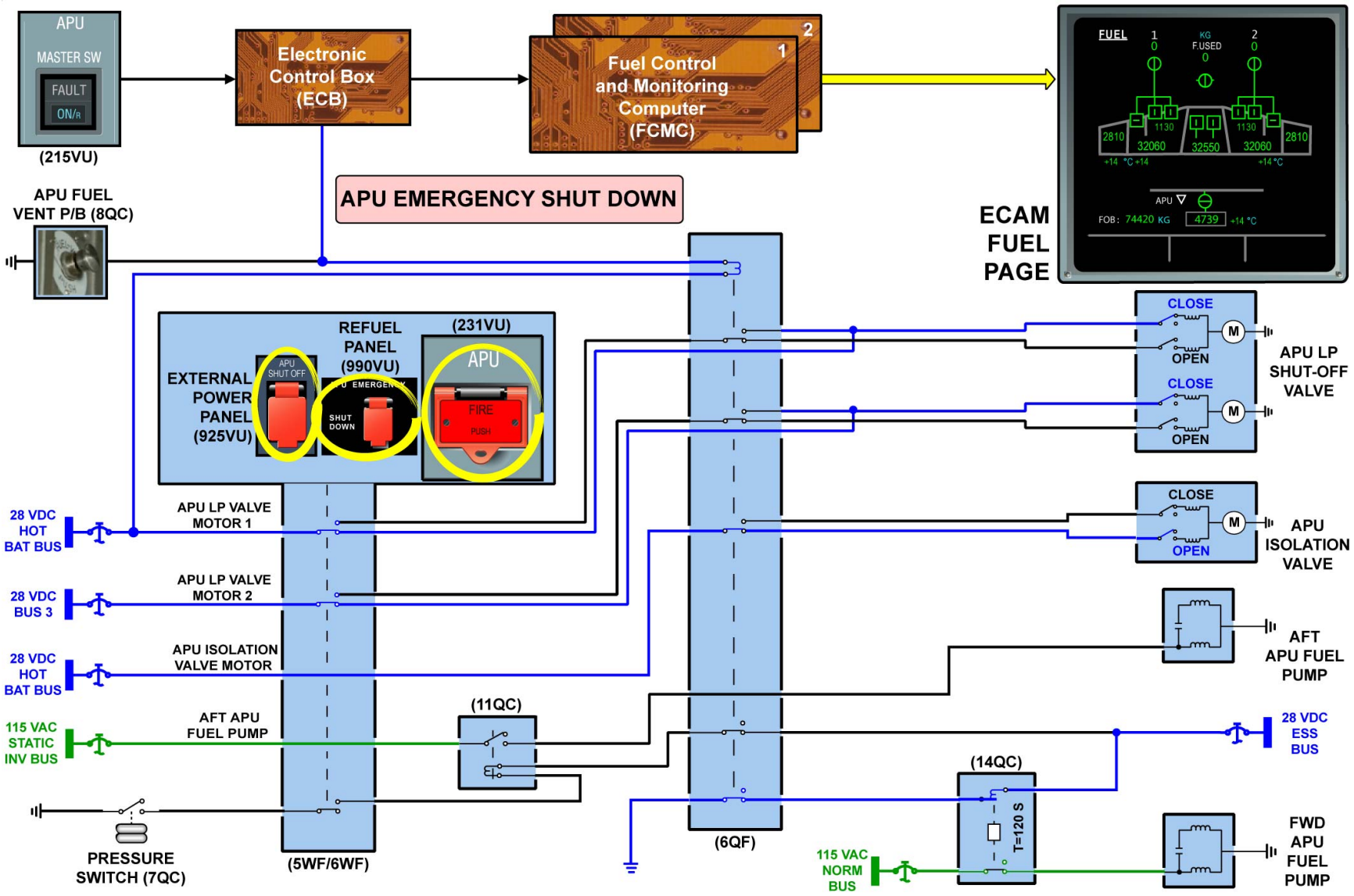


OPERATION - APU EMERGENCY SHUT-OFF OPERATION

G9409341 - GAUT0T0 - FM28D5000000003

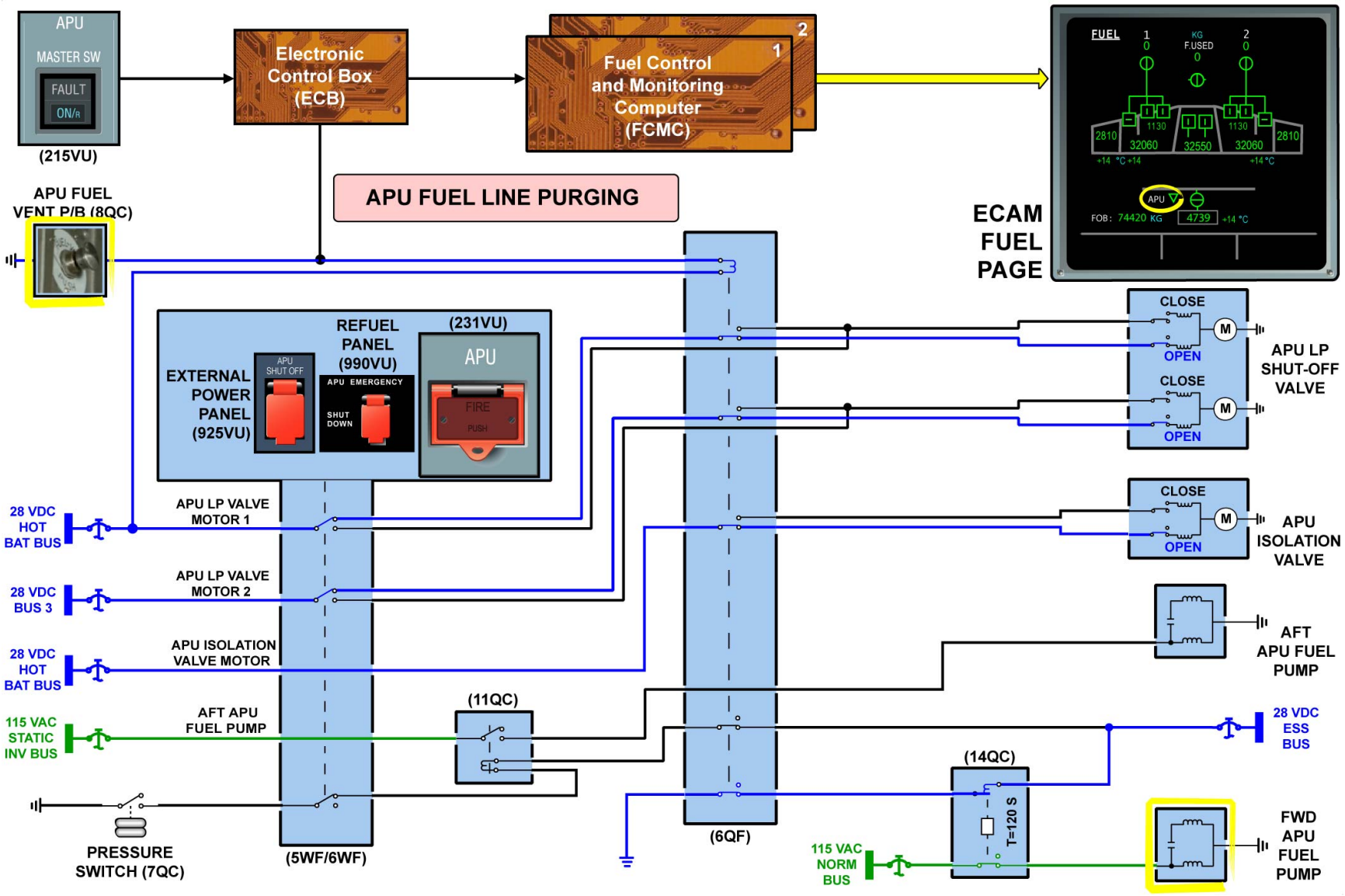
APU FEED D/O (3)

OPERATION (continued)

APU FUEL LINE PURGING

By pressing and holding the APU fuel line vent P/B in the APU compartment, the APU fuel feed system will be controlled in the same way as the APU MASTER SWitch selection does. This function is used by line maintenance to drain or bleed the APU fuel line. For this procedure we have to use a special vent adapter.

G9409341 - GAUT0T0 - FM28D5000000003



OPERATION - APU FUEL LINE PURGING

G9409341 - GAUT0T0 - FM28D5000000003

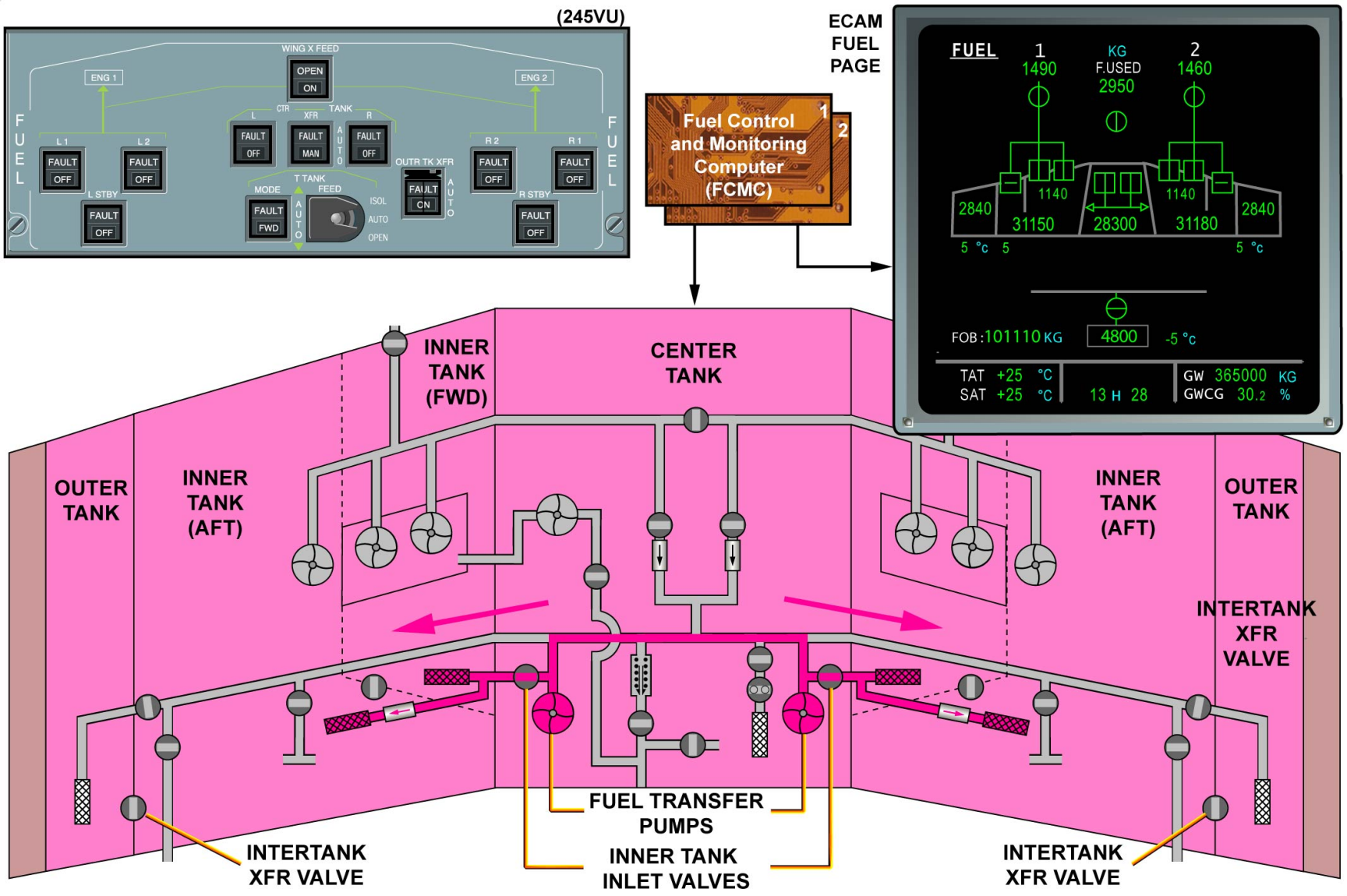
MAIN TRANSFER D/O (A330-200)

GENERAL

The main transfer is automatically controlled by the Fuel Control and Monitoring Computers (FCMCs) but if necessary, the crew can manually override it from the cockpit FUEL panel. It controls the fuel flow from the center and the outer tanks to the two inner tanks. A fuel transfer system involves two steps:
- step 1: center tank to inner tanks, provided there is fuel in the center tank,
- step 2: outer tanks to inner tanks, when the related inner fuel content decreases to a specified level.

The operations are displayed on the ECAM FUEL page.

G9409341 - GAUT0T0 - FM28D6000000003



GENERAL

G9409341 - GAUT0T0 - FM28D600000003

MAIN TRANSFER D/O (A330-200)

DESCRIPTION

This topic describes the components of the main transfer.

FUEL TRANSFER PUMP AND CANISTER

Two centrifugal type fuel transfer pumps are installed in the bottom of the center tank, so that almost all of the fuel can be transferred when necessary. Each pump is driven by a 3-phase 115 VAC motor and is enclosed in a canister that makes it possible to replace the fuel pump element when there is fuel in the center tank. Pumps and canisters are all assembled in the same way and are interchangeable.

TRANSFER CHECK VALVES

The outlet pipe from each fuel transfer pump contains a check valve. This prevents an opposite fuel flow through the pump when it is not in operation.

PRESSURE SWITCHES

Each center tank transfer fuel pump has an output monitoring LP switch attached to the rear spar of the center box. It operates at 6 psi depending on pressure decrease.

INNER TANK INLET VALVES AND ACTUATORS

The inner tank inlet valves, of the ball-valve type, are installed in the fuel supply line of each inner tank. They independently control the flow of fuel from the refuel gallery to the inner tanks. The valves are installed in the center tank and have a spindle which goes through the rear spar to engage with the actuator. The actuator is a single electrical motor and is equipped with a visual position indicator.

INTER-TANK TRANSFER VALVES AND ACTUATORS

Inter-tank transfer valves, of the ball-valve type, are installed in the inner tanks and supply the fuel from the outer tanks to the inner tanks. They are operated by a single electrical motor actuator attached to the wing front spar and equipped with a visual position indicator.

OUTER TANK INLET VALVES AND ACTUATORS

Each outer tank inlet valve is an interface between the refuel gallery and the outer tank. Its primary function is to control the flow of fuel into the outer tank. However, during suction defuel or transfer it controls the fuel flow out of the outer tank.

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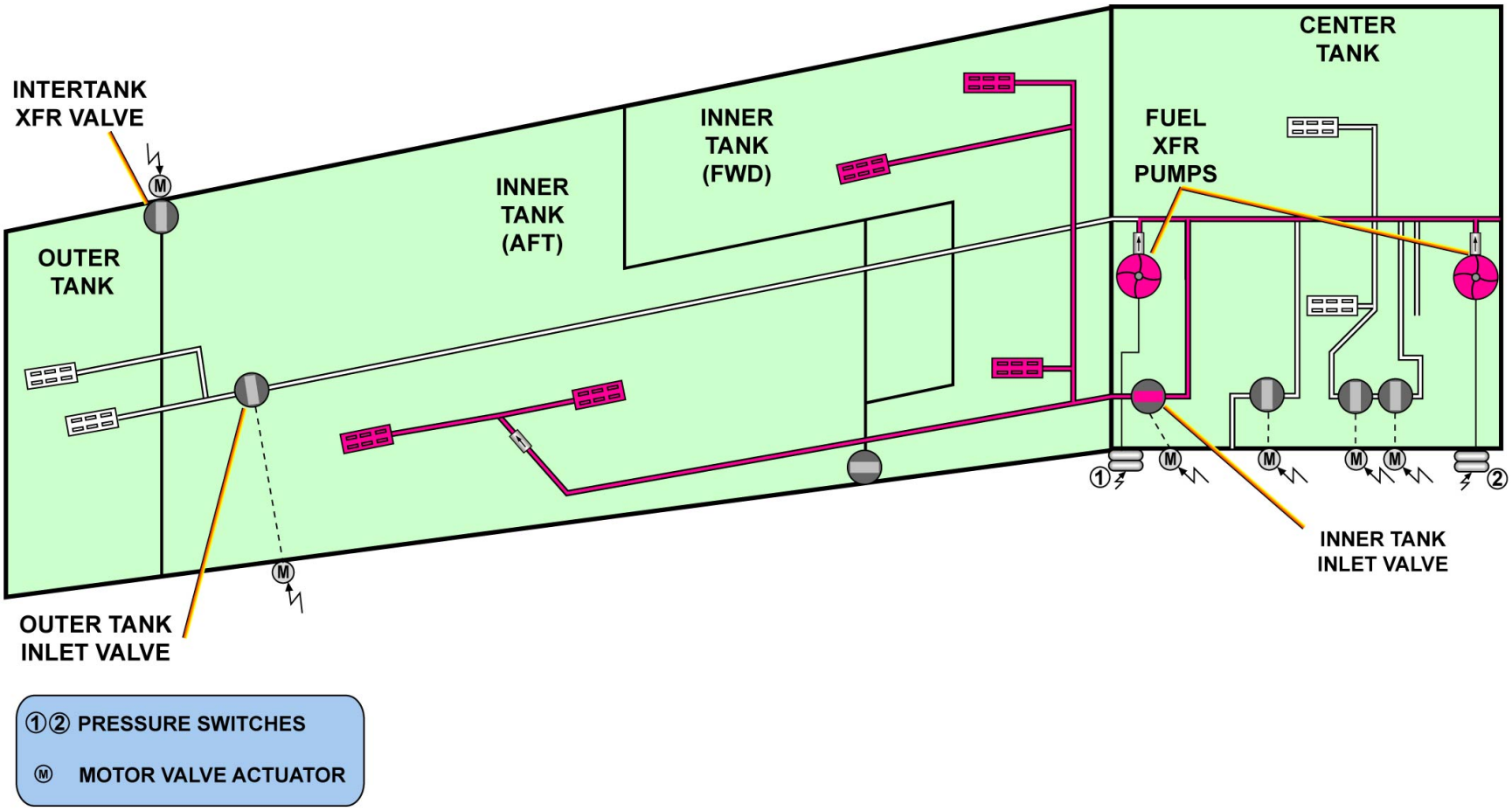

DESCRIPTION - FUEL TRANSFER PUMP AND CANISTER ... OUTER TANK INLET VALVES AND ACTUATORS

G9409341 - GAUT0T0 - FM28D6000000003

MAIN TRANSFER D/O (A330-200)

OPERATION

This topic describes how the main transfer operates.

AUTOMATIC TRANSFER: CENTER TANK TO INNER TANKS

The system uses fuel pump pressure to move fuel from the center tank to the inner tanks.
When the L and R CTR TANK XFR P/Bs are on, the center tank transfer pumps are controlled by the master FCMC to run, provided the center tank contains fuel and the CTR TANK XFR P/Bs are not in the MANual position. The two transfer pumps then operate continuously until the center tank is empty.
Depending on the center tank and inner tank quantities, the FCMC will start center tank to inner tank transfers by controlling the related inner tank inlet valves. One center tank transfer pump selected and operative is sufficient to do a center tank to inner tank transfer.

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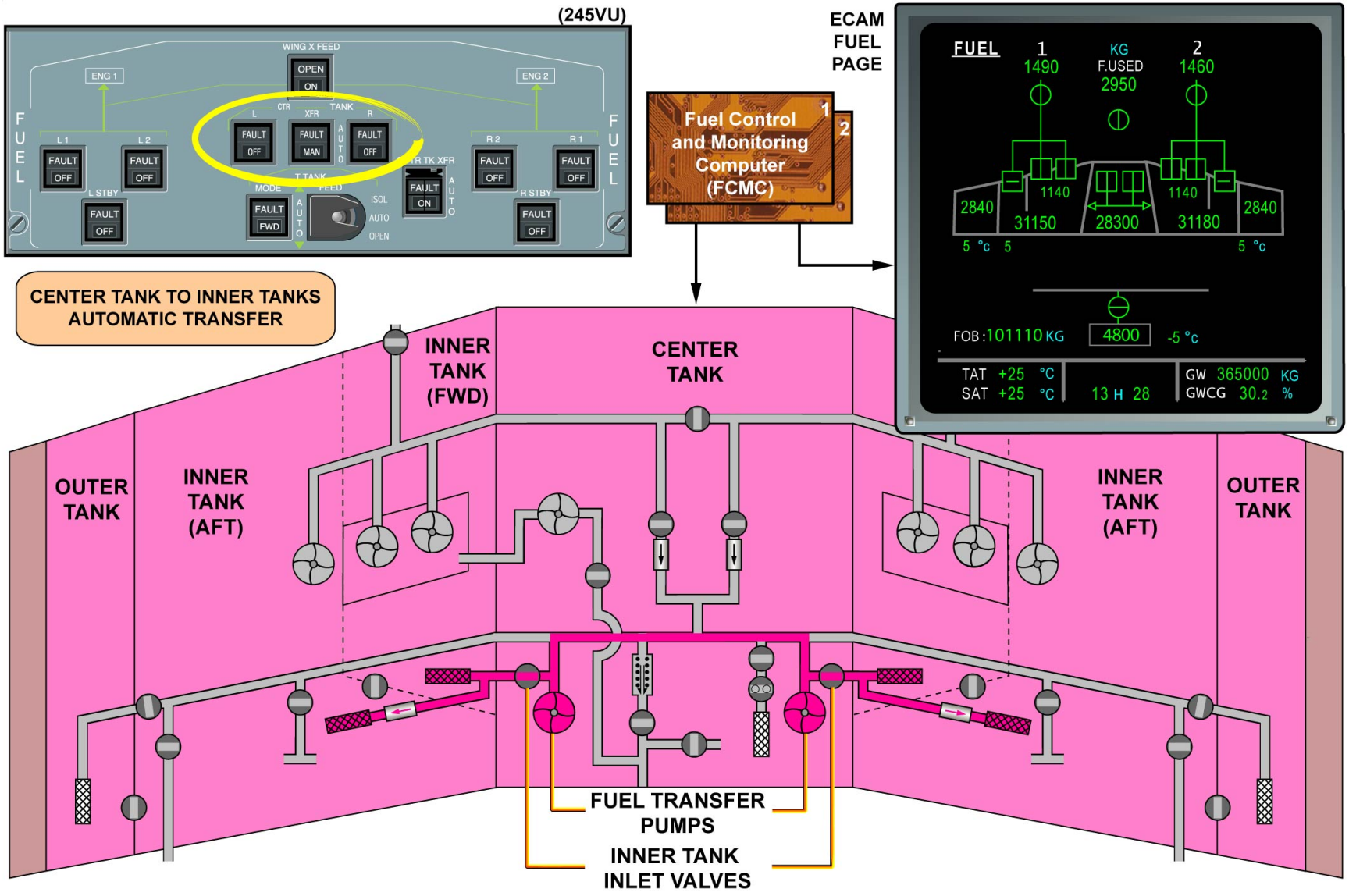

OPERATION - AUTOMATIC TRANSFER: CENTER TANK TO INNER TANKS

G9409341 - GAUT0T0 - FM28D6000000003

MAIN TRANSFER D/O (A330-200)

OPERATION (continued)

CENTER TANK TO INNER TANKS TRANSFER LOGIC

When the fuel content of the inner tanks decreases to underfull (approximately 2000 kg below the hi-level), the Fuel Quantity Indicating (FQI) sends a signal to the FCMC which opens the inner tank inlet valves and starts the center tank to inner tank transfer. When the hi-level in the inner tanks becomes wet, the transfer stops. When the fuel content of the inner tanks decreases to underfull, the center tank to inner tank transfer restarts. This start-and-stop cycle continues until the center tank is empty, the low level is dry and the pumps are at Low Pressure (LP). The FCMC then:

- de-energizes both transfer pumps,
- closes both inner tank inlet valves.

The following process determines whether the center tank is empty:

- when the center tank quantity is low and Low Pressure (LP) is detected in both center tank transfer pumps for more than 5 minutes, the FCMC stops the pumps and closes the inner tank inlet valves.

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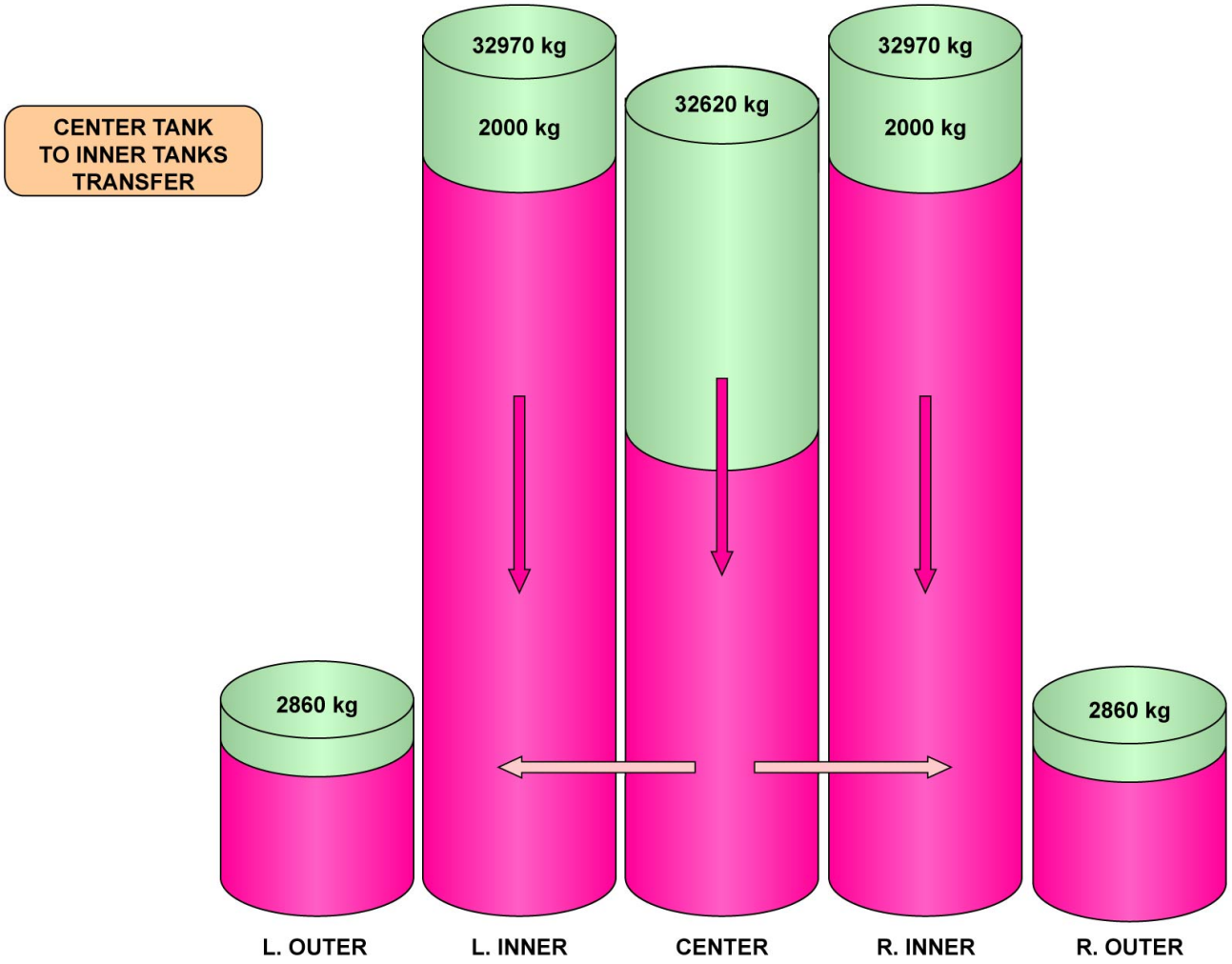

OPERATION - CENTER TANK TO INNER TANKS TRANSFER LOGIC

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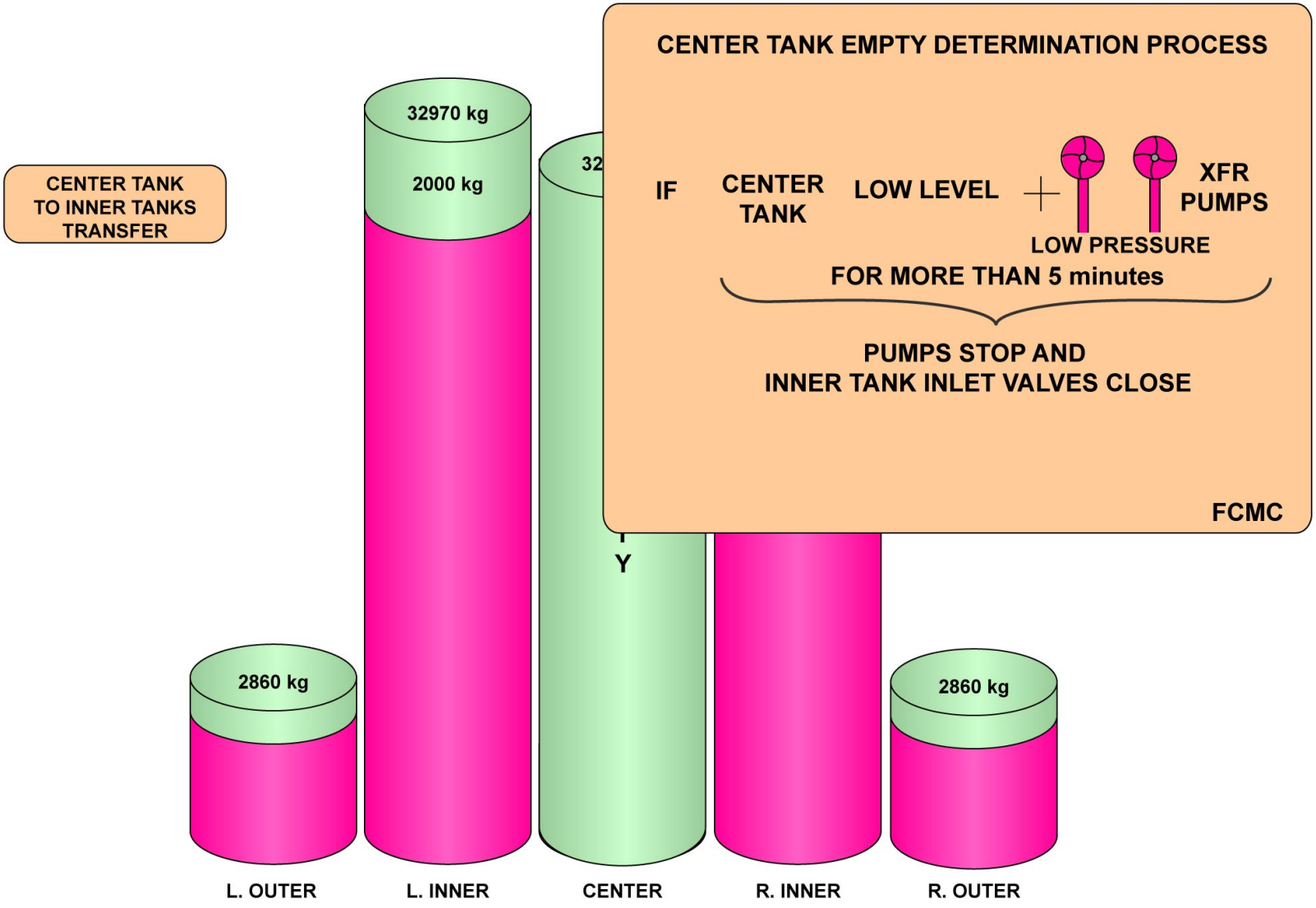

OPERATION - CENTER TANK TO INNER TANKS TRANSFER LOGIC

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MAIN TRANSFER D/O (A330-200)

OPERATION (continued)

MANUAL TRANSFER: CENTER TANK TO INNER TANKS

The CTR TANK XFR P/B on the FUEL control panel gives manual control of the center tank to inner tank transfer. The switch controls the operation of:
- the transfer pumps,
- the inner tank inlet valves.

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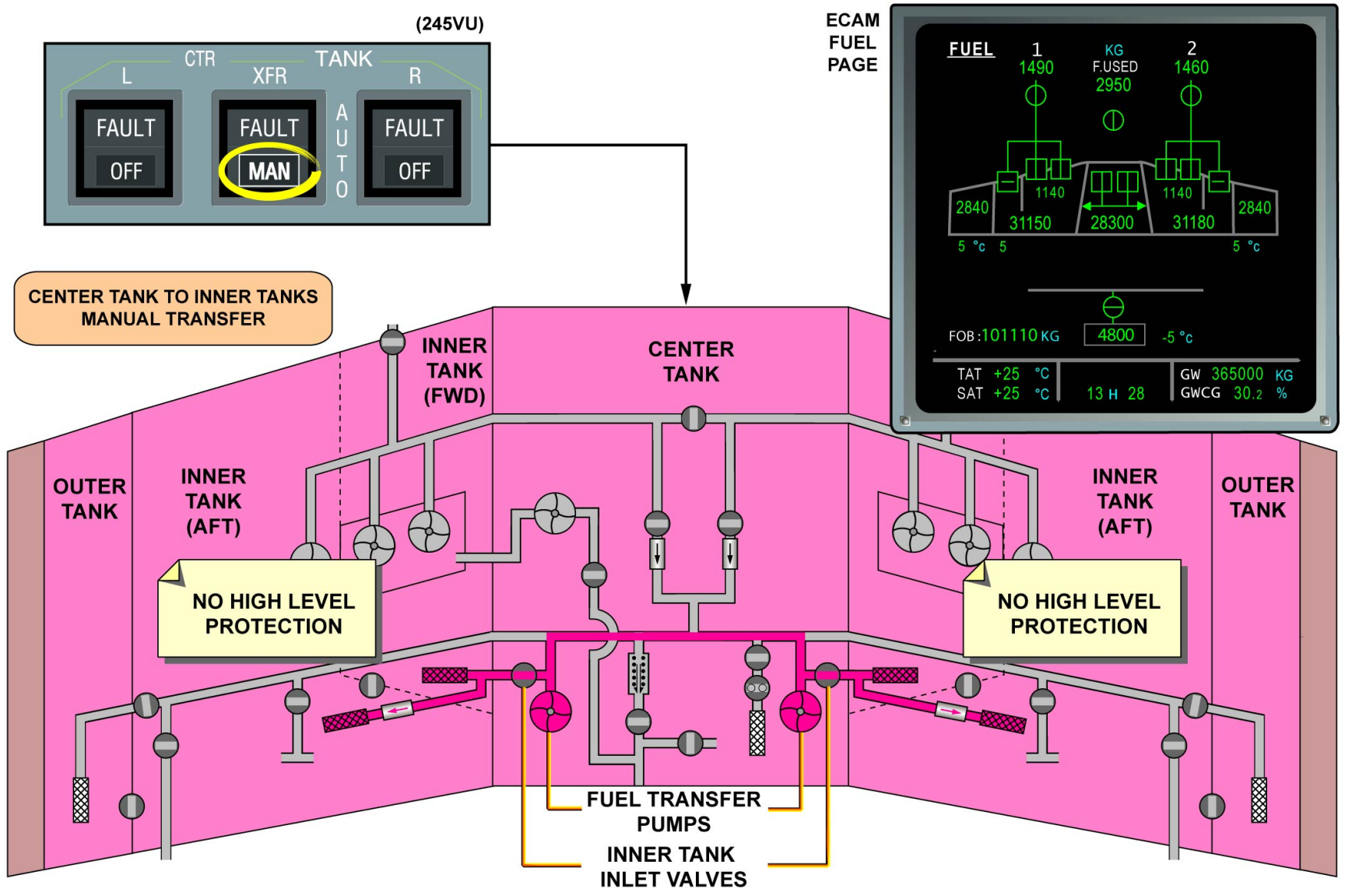

OPERATION - MANUAL TRANSFER: CENTER TANK TO INNER TANKS

G9409341 - GAUT0T0 - FM28D600000003

MAIN TRANSFER D/O (A330-200)

OPERATION (continued)

AUTOMATIC TRANSFER: OUTER TANKS TO INNER TANKS

Gravity is used to move fuel from the outer tanks to the inner tanks under the automatic control of the master FCMC when the OUTR TK XFR P/B is not in the MANual position.
Outer tank to inner tank transfer is activated by the FCMC via 2 inter-tank transfer valves, opening and closing at the same time, depending on the fuel level of the inner tanks.
The operation is displayed on the ECAM FUEL page.

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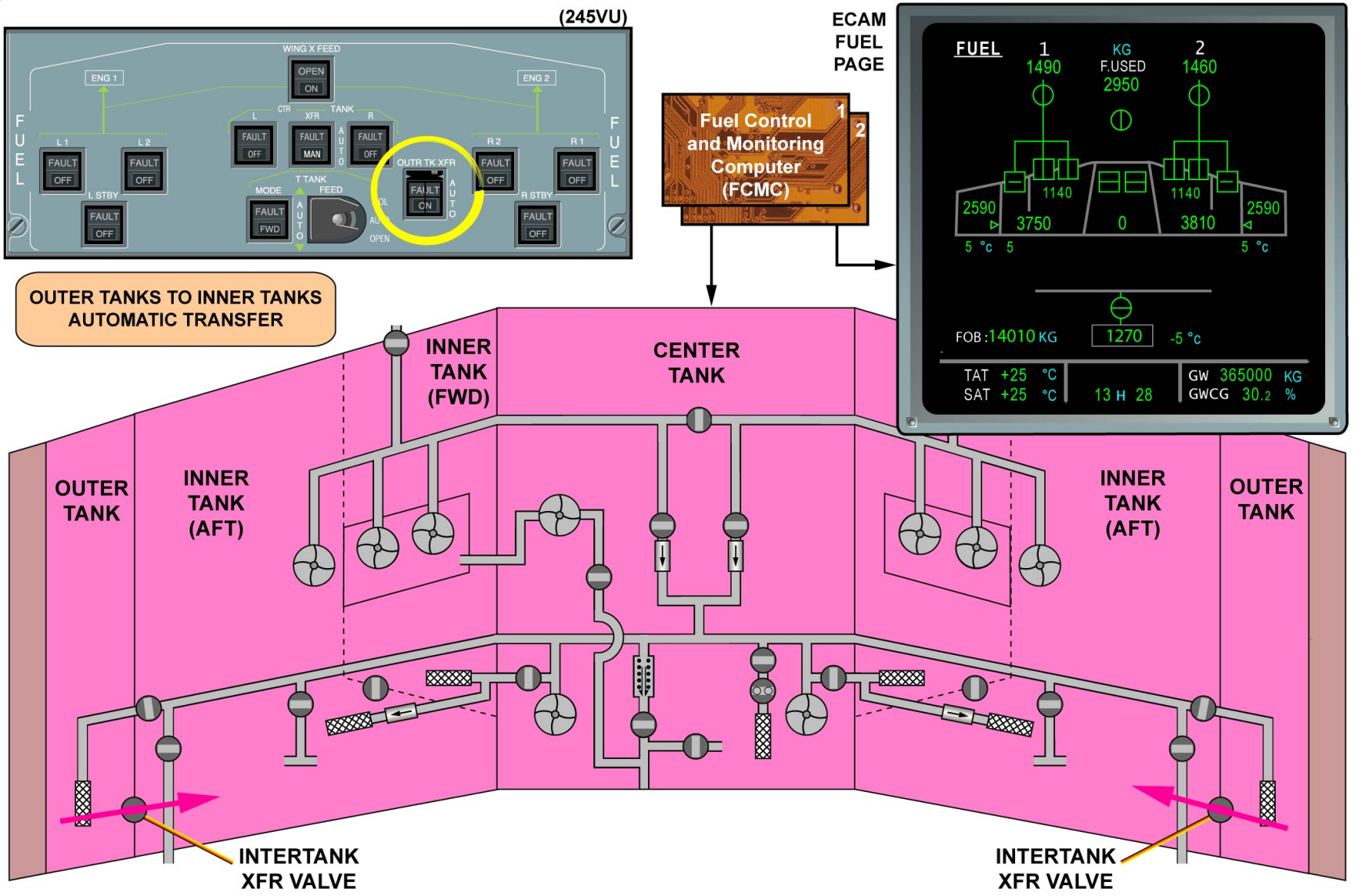

OPERATION - AUTOMATIC TRANSFER: OUTER TANKS TO INNER TANKS

G9409341 - GAUT0T0 - FM28D600000003

MAIN TRANSFER D/O (A330-200)

OPERATION (continued)

OUTER TANKS TO INNER TANKS TRANSFER LOGIC

As the fuel is burned, the fuel content of one of the two inner tanks decreases to low level, which is 3500 kg, on the FQI indication. When this occurs, the two inter-tank transfer valves open and gravity causes the fuel to flow from the outer tanks to the inner tanks. The fuel transfer continues until the fuel content of the inner tanks increases to 4000 kg, and the inter-tank transfer valves close. They open together again when the fuel level in one of the two inner tanks decreases again to 3500 kg.

This transfer cycle continues until the two outer tanks are empty. An outer tank empty condition is met when the outer tank fuel quantity is less than 10 kg for 5 minutes.

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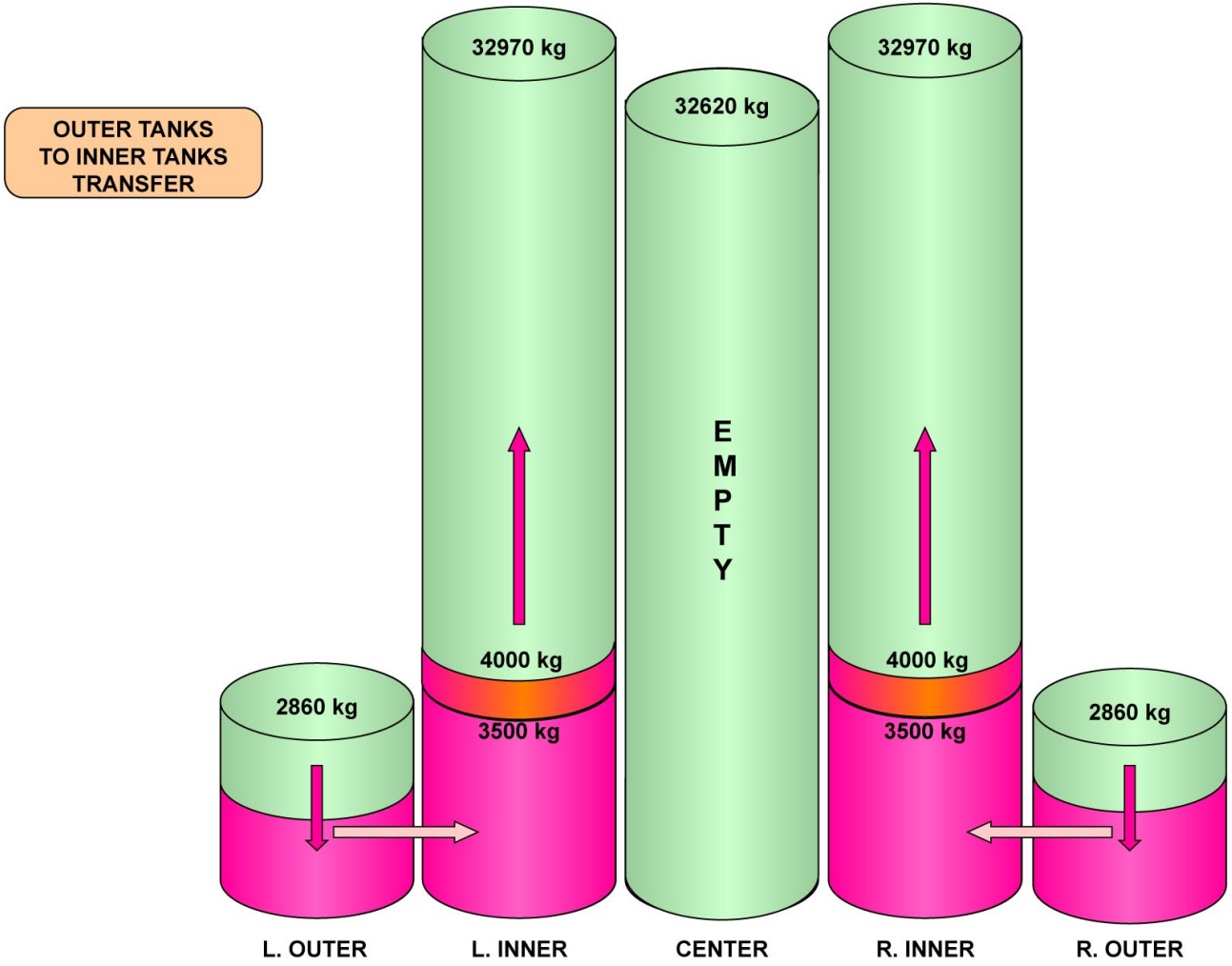

OPERATION - OUTER TANKS TO INNER TANKS TRANSFER LOGIC

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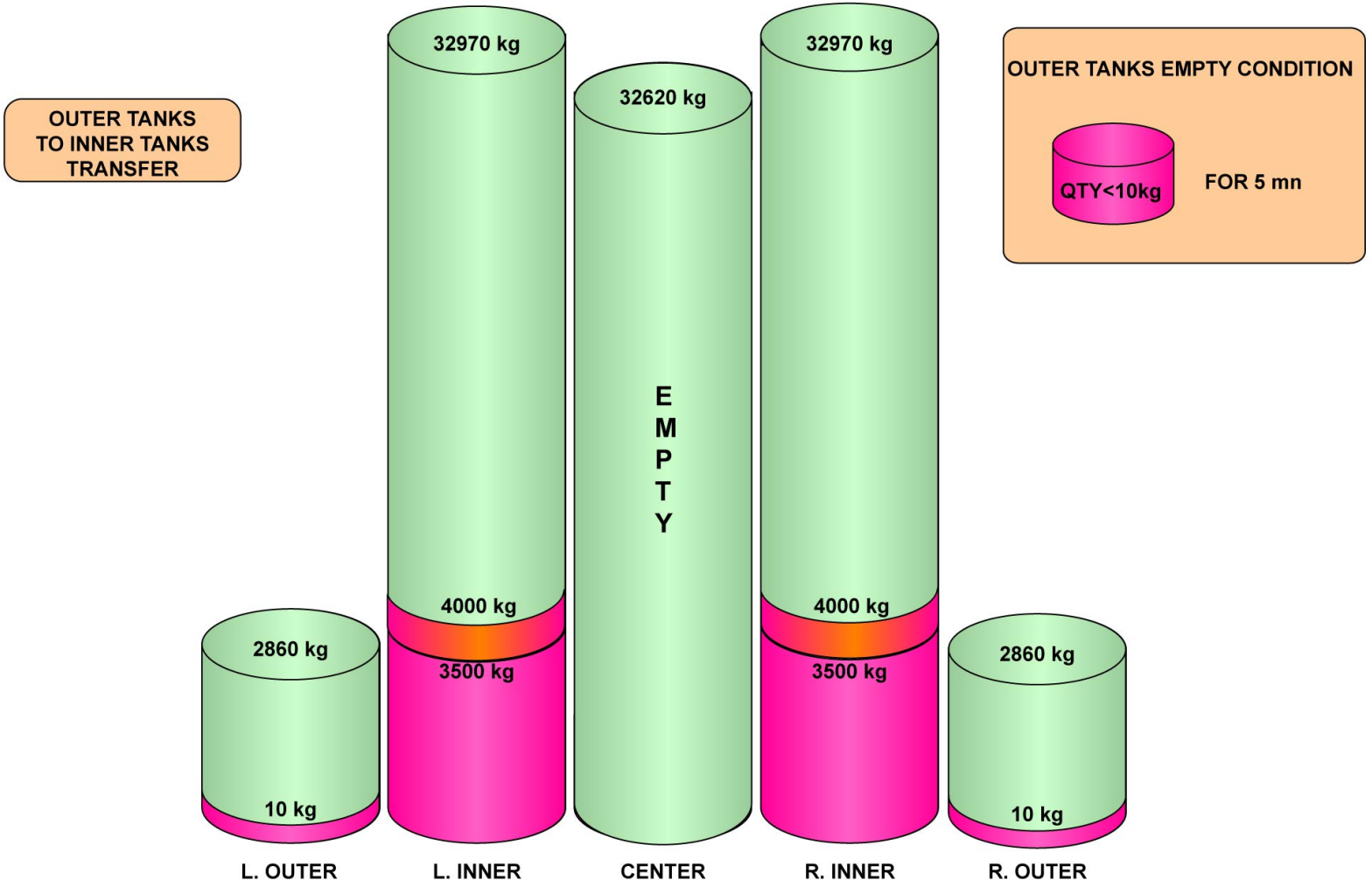

OPERATION - OUTER TANKS TO INNER TANKS TRANSFER LOGIC

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MAIN TRANSFER D/O (A330-200)

OPERATION (continued)

MANUAL TRANSFER: OUTER TANKS TO INNER TANKS

If any failure is detected during automatic transfer from outer tanks to inner tanks, the FCMCs trigger a FAULT light on the OUTR TK XFR P/B, and a message on the ECAM requesting outer tank to inner tank selection.
When the OUTR TK XFR P/B is set to, the inter-tank transfer valves, the outer tank inlet valves and the inner tank inlet valves will be controlled to open.

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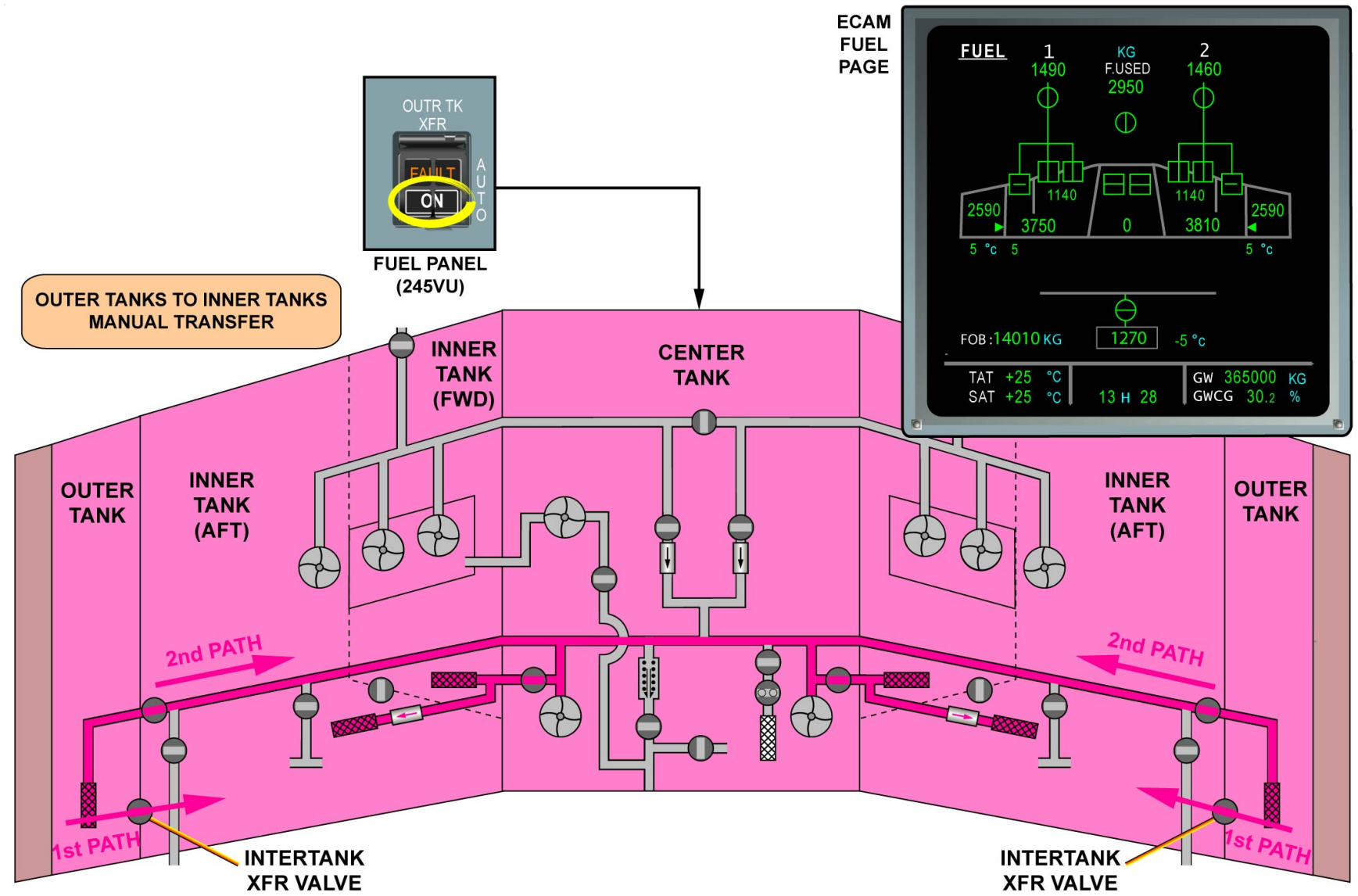

OPERATION - MANUAL TRANSFER: OUTER TANKS TO INNER TANKS

G9409341 - GAUT0T0 - FM28D600000003

MAIN TRANSFER D/O (A330-300)

GENERAL

The main transfer is automatically controlled by the Fuel Control and Monitoring Computers (FCMCs) but if necessary, the crew can manually override it from the cockpit FUEL panel. It controls the fuel flow from the outer tanks to the two inner tanks. This transfer occurs when the related inner fuel content decreases to a specified level. The operations are displayed on the ECAM FUEL page.

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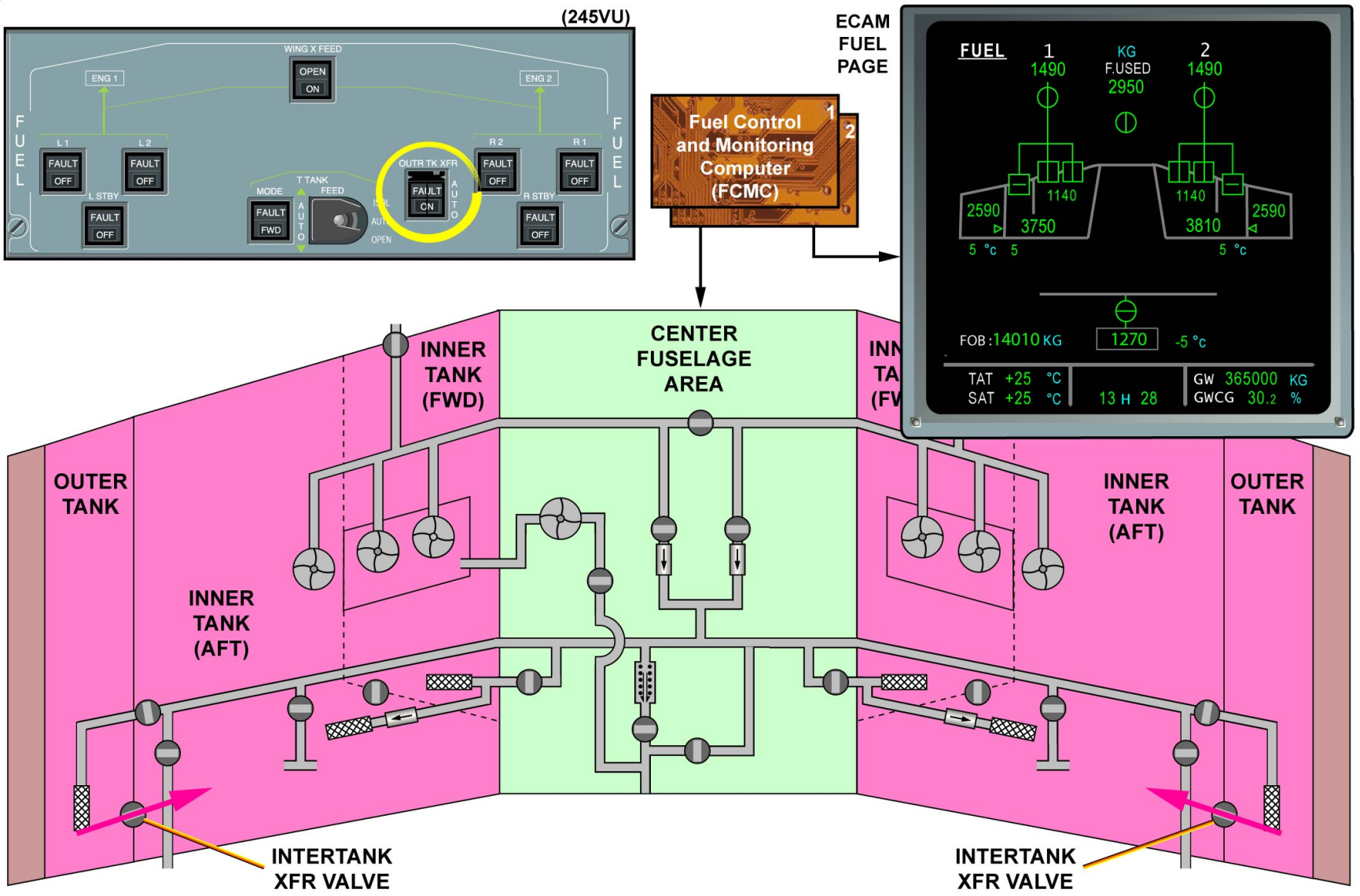
(245VU)
WING X FEED
OPEN
ON
ENG 1
ENG 2
FUEL
L 1
L 2
R 2
R 1
FAULT
OFF
L STBY
R STBY
T TANK
MODE
FEED
FWD
AUTO
OUTR TK XFR
CN
Fuel Control and Monitoring Computer (FCMC)
1
2
ECAM FUEL PAGE
FUEL
1
1490
KG
F.USED
2950
2
1490
1140
2590
3750
3810
5 °C
FOB : 14010 KG
1270
-5 °C
TAT +25 °C
SAT +25 °C
13 H 28
GW 365000 KG
GWCG 30.2 %
CENTER FUSELAGE AREA
INNER TANK (FWD)
OUTER TANK
INNER TANK (AFT)
INTERTANK XFR VALVE

GENERAL

MAIN TRANSFER D/O (A330-300)

DESCRIPTION

This topic describes the components of the main transfer.

OUTER TANK INLET VALVES AND ACTUATORS

Each outer tank inlet valve is an interface between the refuel gallery and outer tank. Its primary function is to control the flow of fuel into the outer tank. But during suction defuel or transfer, it controls the fuel flow out of the outer tank.

INNER TANK INLET VALVES AND ACTUATORS

The inner tank inlet valves, of the ball-valve type, are installed in the fuel supply line of each inner tank. They independently control the flow of fuel from the refuel gallery to the inner tanks. The valves are installed in the center tank and have a spindle which goes through the rear spar to engage with the actuator. The actuator is a single electrical motor and has a visual position indicator.

INTERTANK TRANSFER VALVES AND ACTUATORS

Intertank transfer valves, of the ball-valve type, are installed in the inner tanks and supply the fuel from the outer tanks to the inner tanks. A single electrical motor actuator attached to the wing front spar with a visual position indicator operates them.

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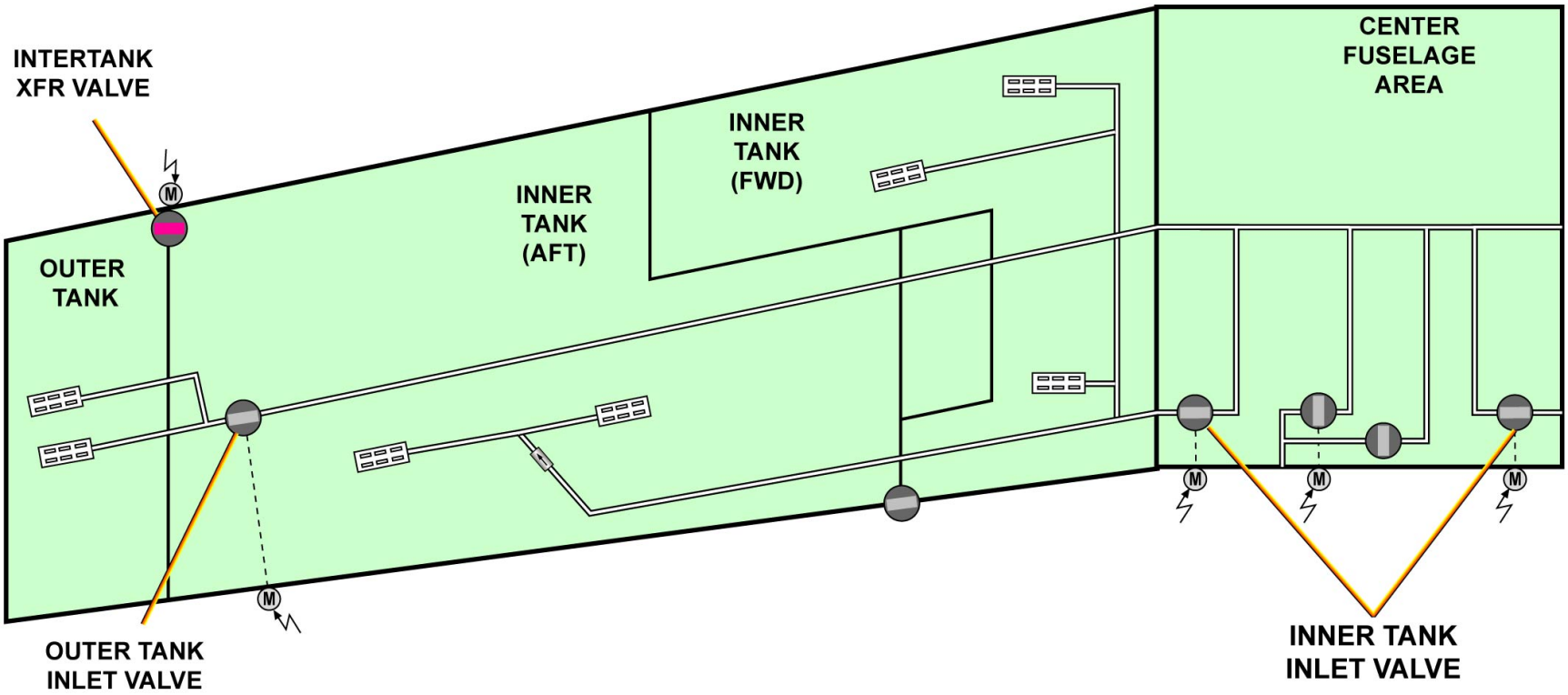

DESCRIPTION - OUTER TANK INLET VALVES AND ACTUATORS ... INTERTANK TRANSFER VALVES AND ACTUATORS

G9409341 - GAUT0T0 - FM28D6000000009

MAIN TRANSFER D/O (A330-300)

OPERATION

This topic describes the operation of the main transfer.

OUTER TANKS TO INNER TANKS AUTOMATIC TRANSFER

Gravity is used to move fuel from the outer tanks to the inner tanks under automatic control of the master FCMC when the OUTR TK XFR P/B is not in MANual position.
Outer tanks to inner tanks transfer is activated by the FCMC via 2 intertank transfer valves, opening and closing at the same time, depending on inner tanks fuel level.
The operation is displayed on the ECAM FUEL page.

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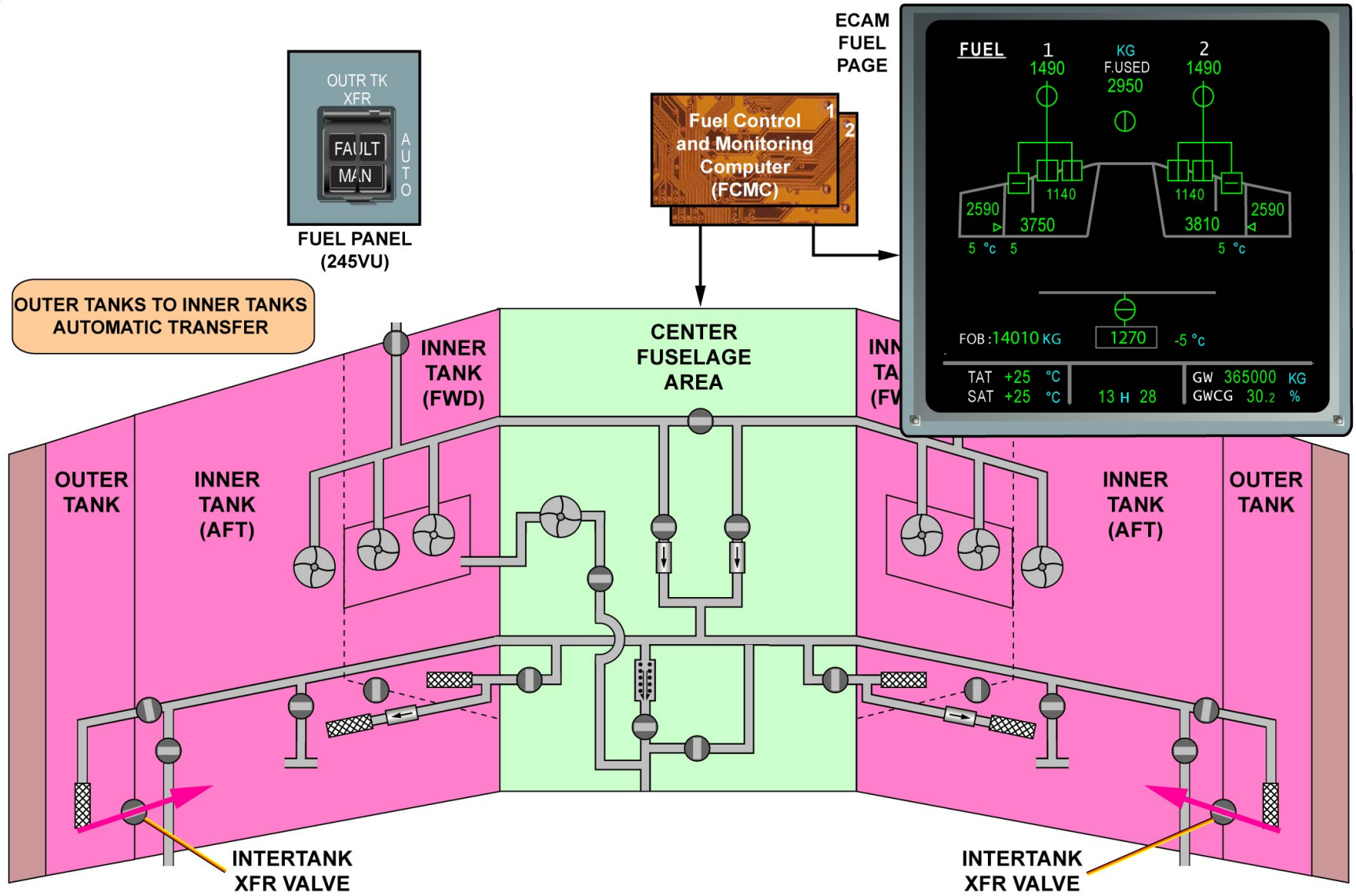

OPERATION - OUTER TANKS TO INNER TANKS AUTOMATIC TRANSFER

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MAIN TRANSFER D/O (A330-300)

OPERATION (continued)

OUTER TANKS TO INNER TANKS TRANSFER LOGIC

As the fuel is burned, the fuel contents of one of the two inner tanks decreases to low level which is 3500 kg, on the Fuel Quantity Indicating (FQI) indication. When this occurs, the two intertank transfer valves open and gravity causes the fuel to flow from the outer tanks to the inner tanks. The fuel transfer goes on until the fuel contents of the inner tanks increase to 4000 kg, and the intertank transfer valves close. They open together again when the fuel level in one of the two inner tanks decreases again to 3500 kg.
This transfer cycle continues until the two outer tanks are empty. An outer tank empty condition is met when the outer tank fuel quantity is less than 10 kg for 5 minutes.

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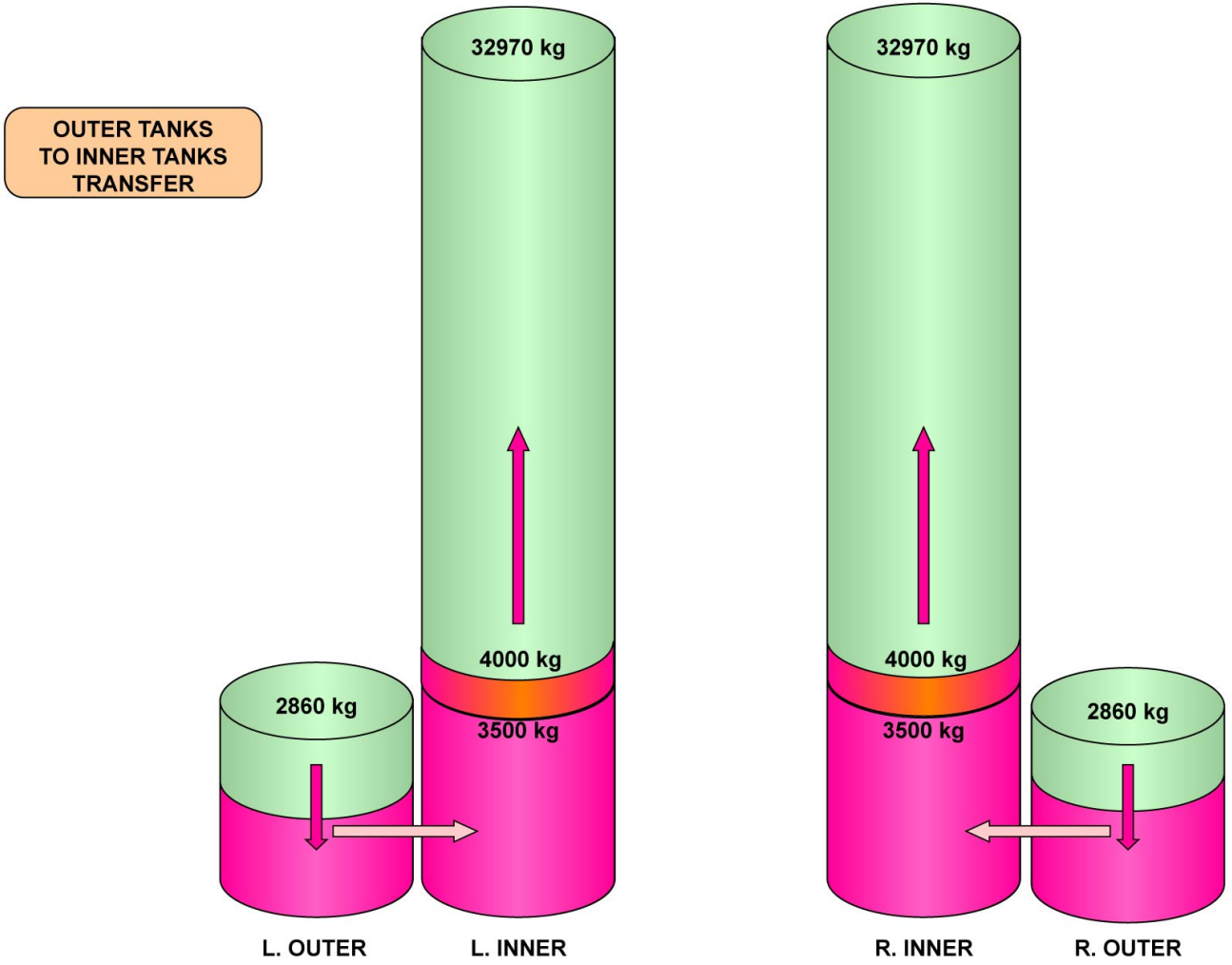

OPERATION - OUTER TANKS TO INNER TANKS TRANSFER LOGIC

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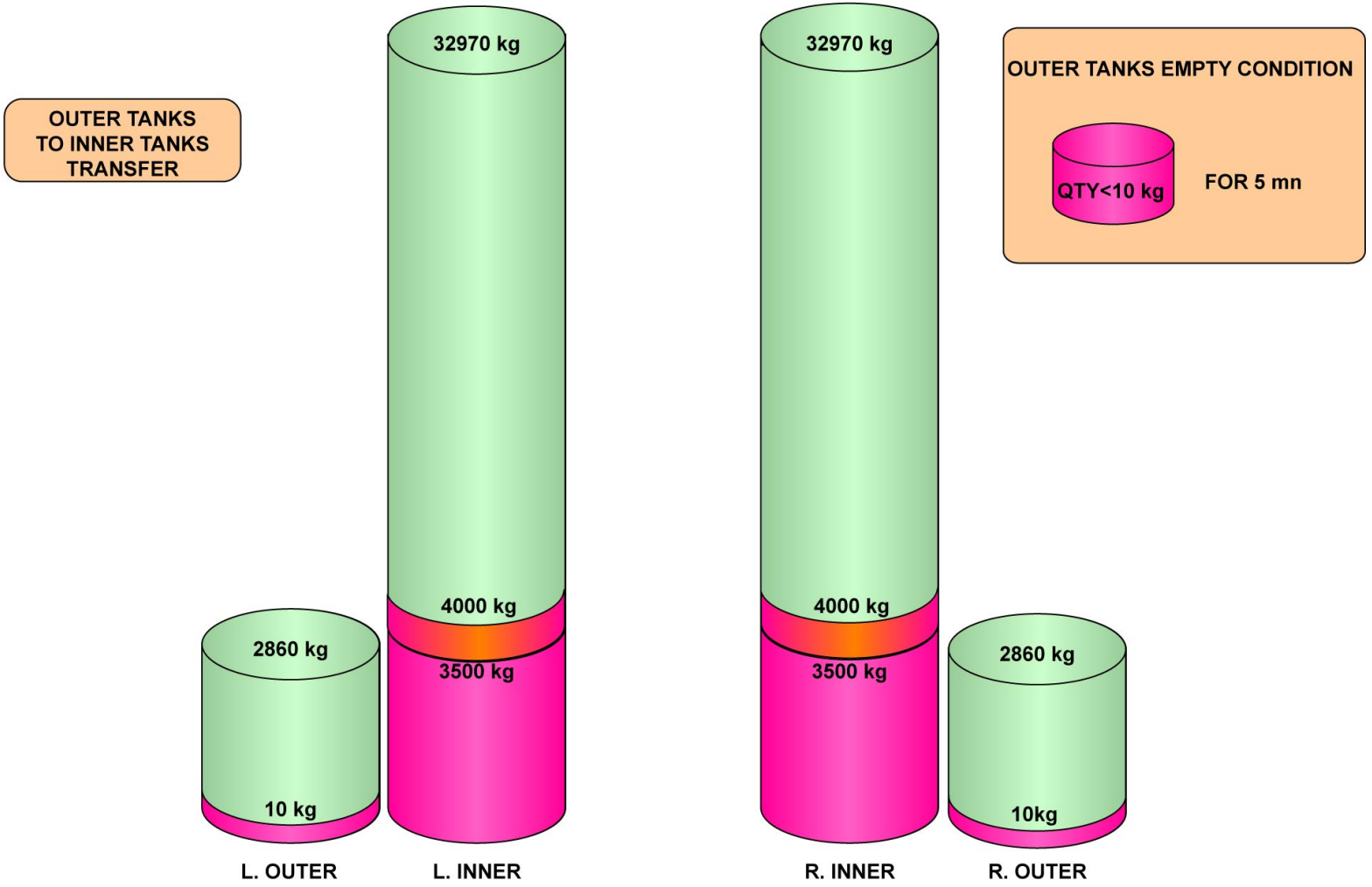

OPERATION - OUTER TANKS TO INNER TANKS TRANSFER LOGIC

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MAIN TRANSFER D/O (A330-300)

OPERATION (continued)

OUTER TANKS TO INNER TANKS MANUAL TRANSFER

If any failure is detected during outer tanks to inner tanks automatic transfer, the FCMCs trigger a FAULT light on the OUTR TK XFR P/B, and a message on the ECAM requesting outer tanks to inner tanks MANual selection.
When the OUTR TK XFR P/B is set to MANual, the intertank transfer valves, the outer tank inlet valves and the inner tank inlet valves will be controlled open.

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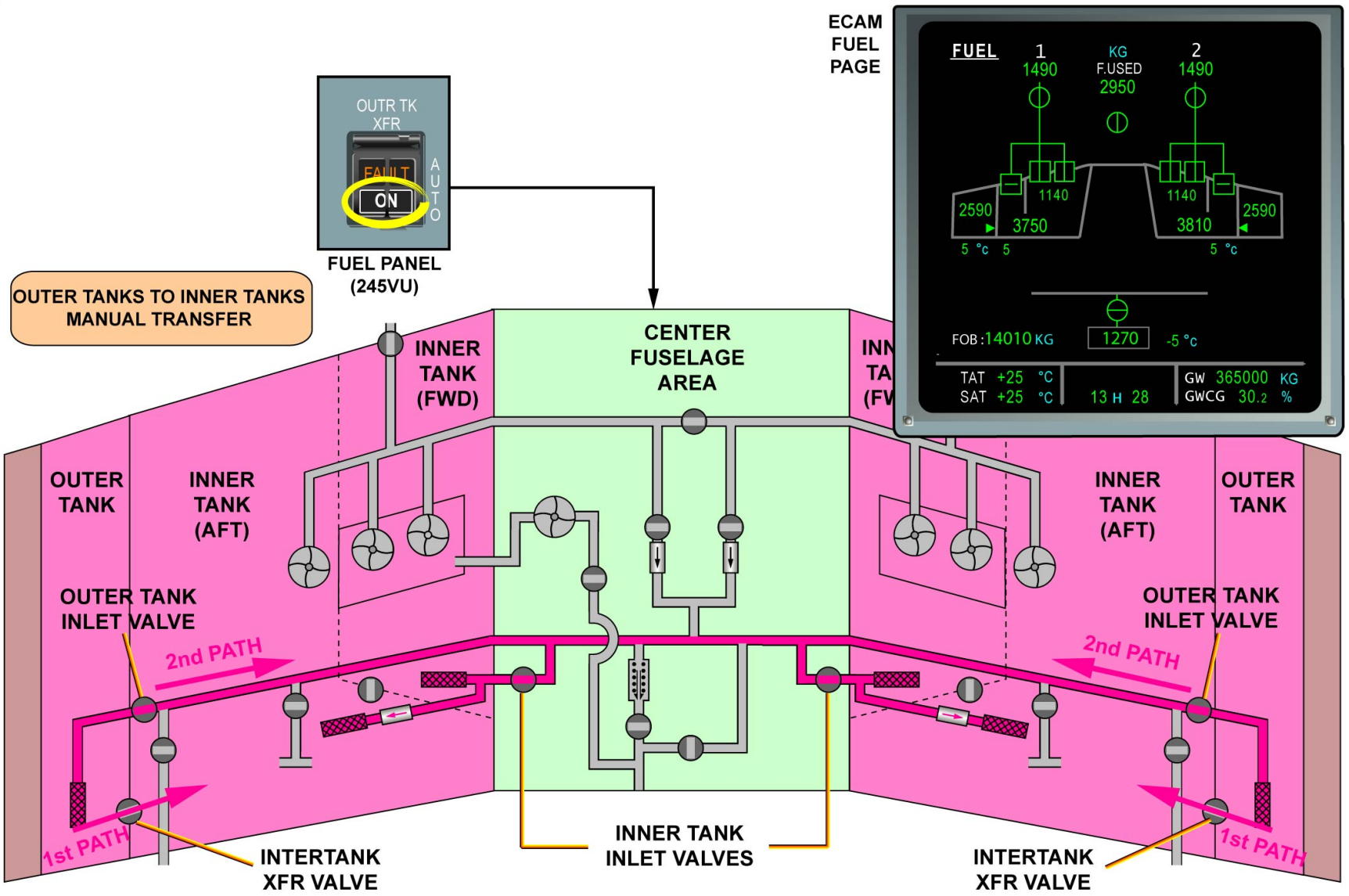

OPERATION - OUTER TANKS TO INNER TANKS MANUAL TRANSFER

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TRIM TRANSFER D/O (A330-200)

GENERAL

The trim transfer system controls the Center of Gravity (CG) of the A/C during flight in order to reduce the THS aerodynamic drag and consequently to minimize the fuel consumption. When the aircraft is in cruise, the trim transfer system optimizes the CG position to increase fuel economy by reducing drag. Normally, only one AFT fuel transfer occurs per flight. However, if the CG in cruise is ahead of the target by more than 2%, and the trim quantity is below 3000kg (6620 lbs), an additional aft transfer will occur. An aft transfer stops, when the computed Cg equals target CG - 0,5%.
The Fuel Control and Monitoring Computers (FCMCs) calculate the CG of the A/C and compare the result to a memorized target value. If necessary, the FCMCs then make a decision to move fuel aft or FWD to control the CG. Usually only one aft transfer is made during each flight. But, as the fuel burns, many small FWD transfers are made.
The ECAM gives trim transfer system information to the crew.

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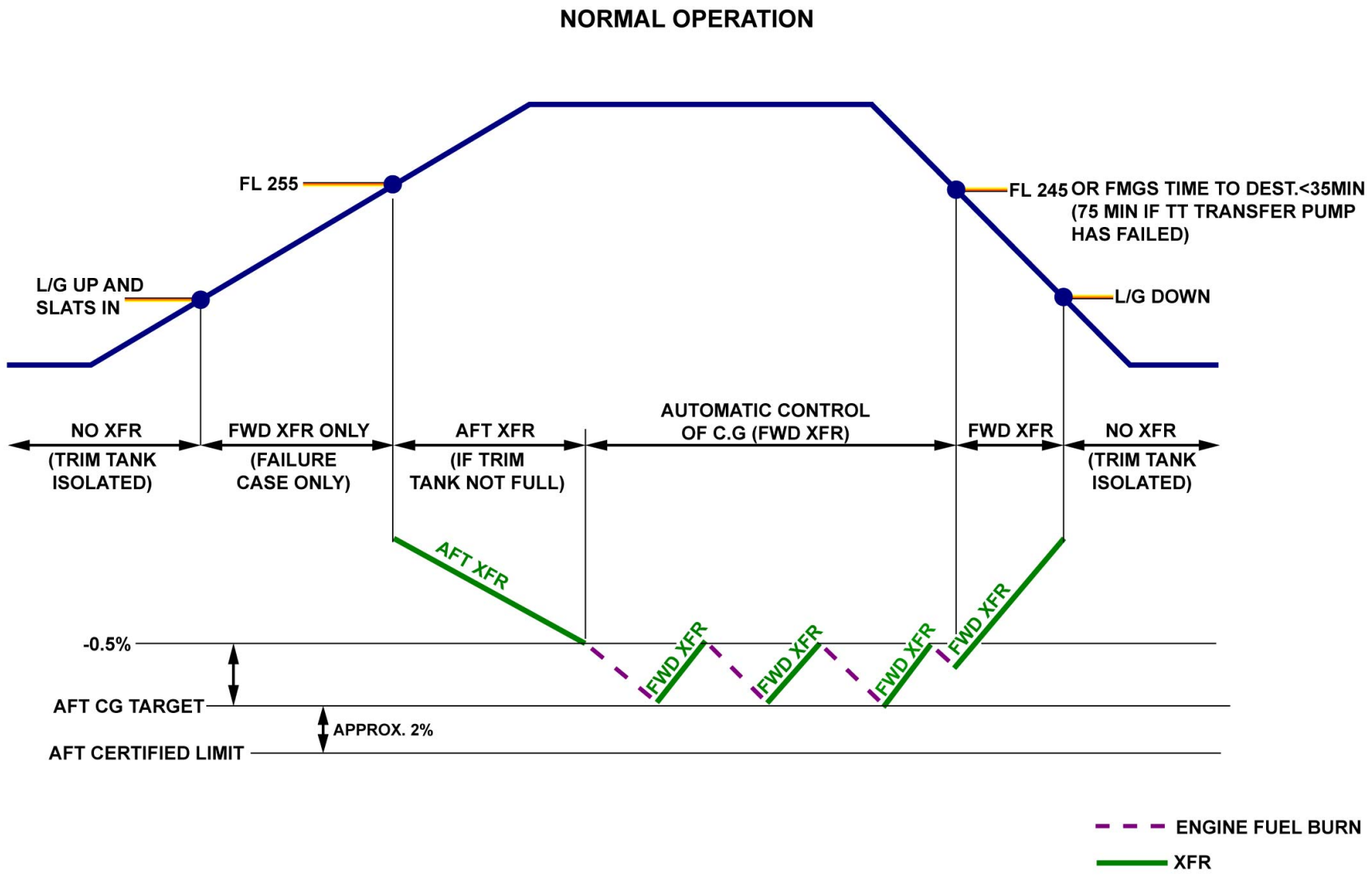

GENERAL

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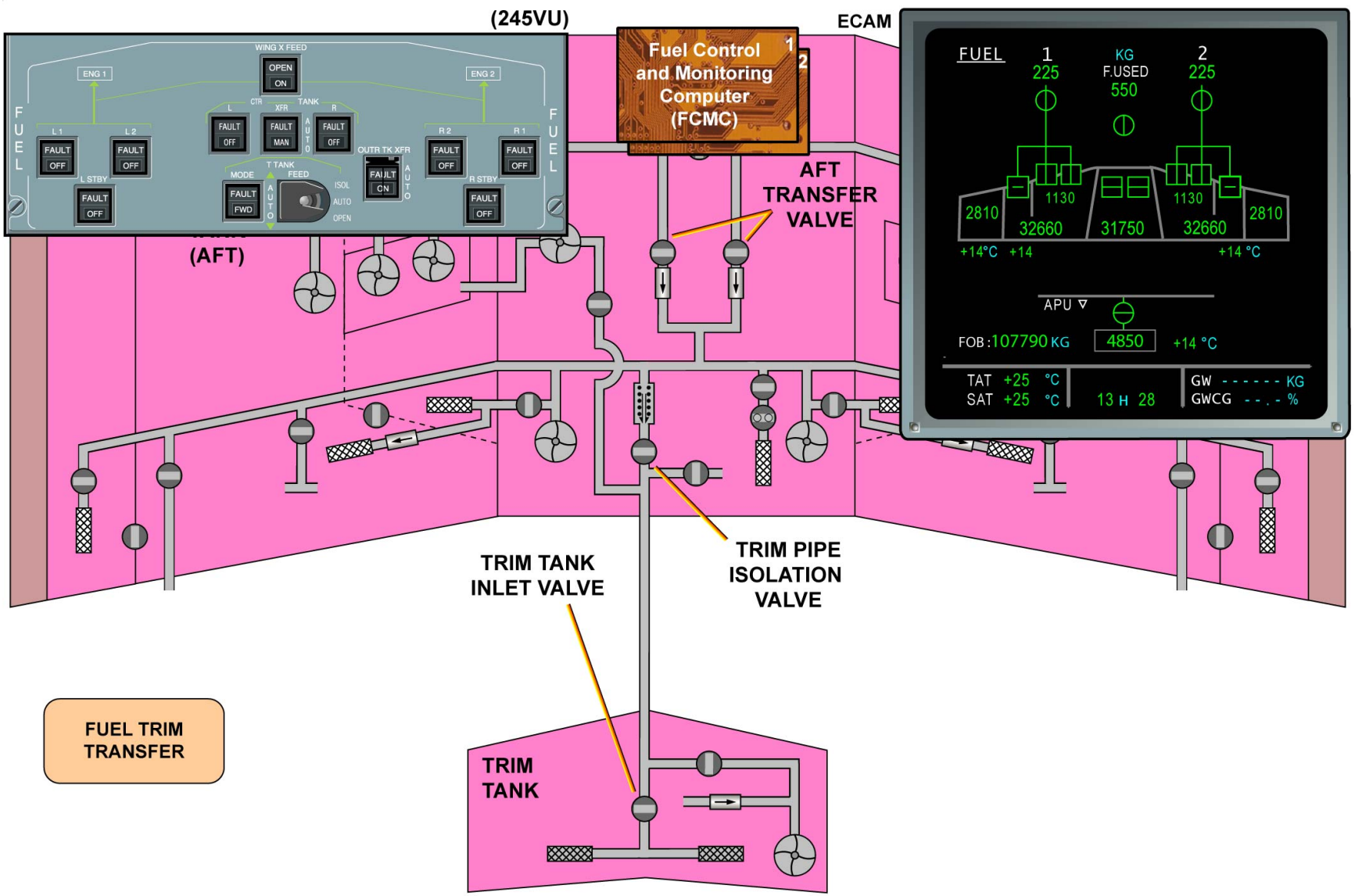
(245VU)
ECAM
Fuel Control and Monitoring Computer (FCMC)
1
2
AFT TRANSFER VALVE
(AFT)
TRIM TANK INLET VALVE
TRIM PIPE ISOLATION VALVE
TRIM TANK
FUEL TRIM TRANSFER
FUEL
1
225
KG
F.USED
550
2
225
2810
1130
32660
31750
1130
32660
2810
+14°C
+14
+14 °C
APU
FOB : 107790 KG
4850
+14 °C
TAT +25 °C
SAT +25 °C
13 H 28
GW ------ KG
GWCG --.- %

GENERAL

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G9409341 - GAUT0T0 - FM28D7000000003

TRIM TRANSFER D/O (A330-200)

DESCRIPTION

TRIM PIPE ISOLATION VALVE, AUXILIARY FORWARD TRANSFER VALVE AND ACTUATORS

A trim pipe isolation valve and an auxiliary FWD transfer valve, both of the ball valve type, are installed in the center tank and attached to the FWD face of the rear spar in the center tank. The trim pipe isolation valve is installed at the FWD end of the fuel supply pipe to the trim tank to control all the aft transfers and the FWD transfers to the wings. The auxiliary FWD transfer valve is installed in the trim pipe, in the center tank, to control the fuel flow from the trim tank to the center tank.
Each one is operated with a single electrical motor actuator attached to the rear face of the center tank rear spar and equipped with a visual position indicator.

TRIM TANK ISOLATION VALVE AND ACTUATOR

A trim tank isolation valve, of the ball valve type, is installed in the fuel line from the trim tank to the trim pipe in order to control the FWD transfer of fuel from the trim tank to the trim pipe. It is installed at the bottom of the trim tank. It is operated with an electrical motor actuator attached to the bottom skin of the trim tank and equipped with a visual position indicator.

TRIM TANK INLET VALVE AND ACTUATOR

A trim tank inlet valve, of the ball valve type, is installed in the fuel supply pipe to the trim tank in order to control the flow of fuel into the trim tank. The valve is in the trim tank and is attached to the bottom skin of the trim tank. It is operated with an electrical motor actuator attached to the bottom skin of the trim tank and equipped with a visual position indicator.

AFT TRANSFER PUMPS AND CANISTERS

The aft transfer pumps are installed in the center tank and inner tanks 1, 2. When in operation, each pump supplies fuel from its related fuel tank to the trim transfer system and the jettison system. Each pump is driven by a 3-phase 115 VAC motor and is enclosed in a canister attached to the tank bottom skin. Pumps and canisters are all assembled in the same way and are interchangeable.

TRIM TRANSFER PUMP, PRESSURE SWITCH AND JET PUMPS

The fuel trim transfer pump is installed horizontally and attached to the FWD and right side face of the trim tank. The pump unit is enclosed in a removable sealing case externally bolted onto the trim tank FWD face. The impeller type pump element is driven by a 3-phase 115 VAC motor and installed in the pump housing. A 6 to 8 psi pump pressure switch is also installed on the pump housing. Inside the tank, the 2 outlets on the pump housing are connected to the trim pipe.

TRANSFER PUMPS CHECK VALVES

The outlet pipe from fuel transfer pump contains a check valve. It prevents an opposite fuel flow through the pump when it is not in operation.

TRIM TRANSFER PUMP PRESSURE SWITCH

The trim transfer pump has an output monitoring LP switch which operates between 6 and 8 psi depending on pressure increase or decrease.

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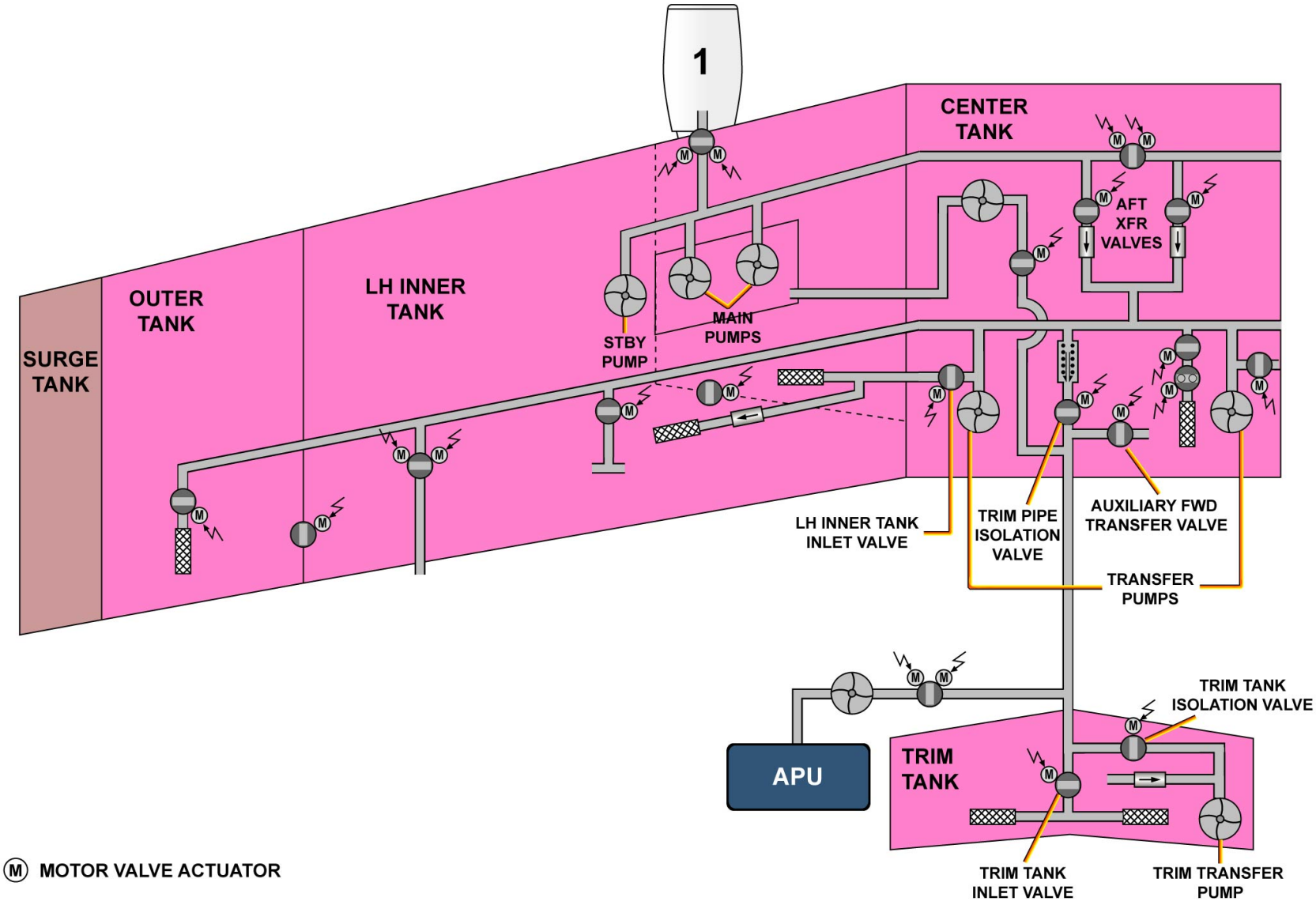

DESCRIPTION - TRIM PIPE ISOLATION VALVE, AUXILIARY FORWARD TRANSFER VALVE AND ACTUATORS ... TRIM TRANSFER PUMP PRESSURE SWITCH

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TRIM TRANSFER D/O (A330-200)

TRIM TRANSFER CONTROL

Before each flight, the crew inputs the A/C Zero Fuel Center of Gravity (ZFCG) and Zero Fuel Weight (ZFW) data into the Flight Management Guidance and Envelope Computers (FMGECs) via the MCDU. The two FMGECs independently transmit this data to the FCMCs.
Each FCMC uses the ZFW from the FMGECs and the tanks fuel weight to calculate the A/C Gross Weight (GW). This GW is output to the ECAM FUEL page, and is used, in the FCMCs, to obtain the target CG from the memorized CG versus percentage of Mean Aerodynamic Chord (MAC) CG table.
In the same time, the FCMCs calculate the fuel weight CG using the FQI, the pitch, roll and acceleration data from the Air Data Inertial Reference Units (ADIRUs) 1 and 2, and the THS position from the Flight Control Data Concentrators (FCDCs). Then, with the ZFWCG transmitted by the FMGECs and the fuel weight CG, the FCMCs calculate the Gross Weight Center of Gravity (GWCG). This GWCG is output to the ECAM FUEL page. The FCMCs, in their transfer logic part, compare the GWCG with the target CG to determine if a FWD transfer or an aft transfer is needed.
CG control during automatic operation:
The FMGEC independently monitors the CG of the A/C. If it detects that the A/C CG is too far aft, it sends a signal "CG target FWD" to the FCMCs. The master FCMC moves the target CG forward 2.0% MAC. This is latched until the end of the flight. If the FMGEC detects that the CG is still aft of the new target CG, it sends a signal to the FCMCs. The FCMCs then move the target CG forward 0.5% MAC for 10 minutes. After 10 minutes the system goes back to normal operation.
This procedure can occur twice more until the target CG is first 4.0% then 6.0% MAC forward of the initial position. If the error is detected again, the FCMC stops the CG control and shows an ECAM warning to the crew. The crew then manually sets a forward transfer.

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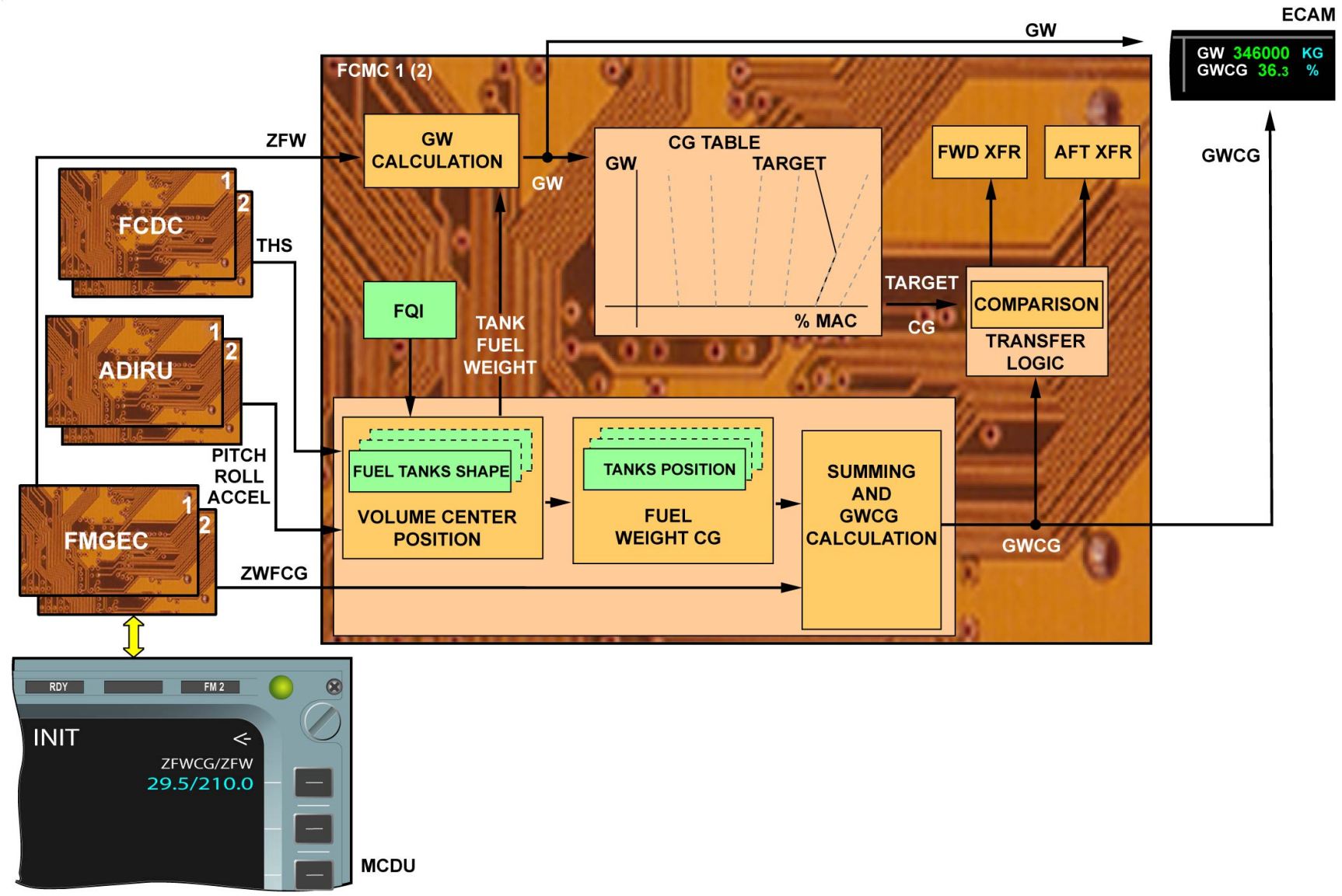

TRIM TRANSFER CONTROL

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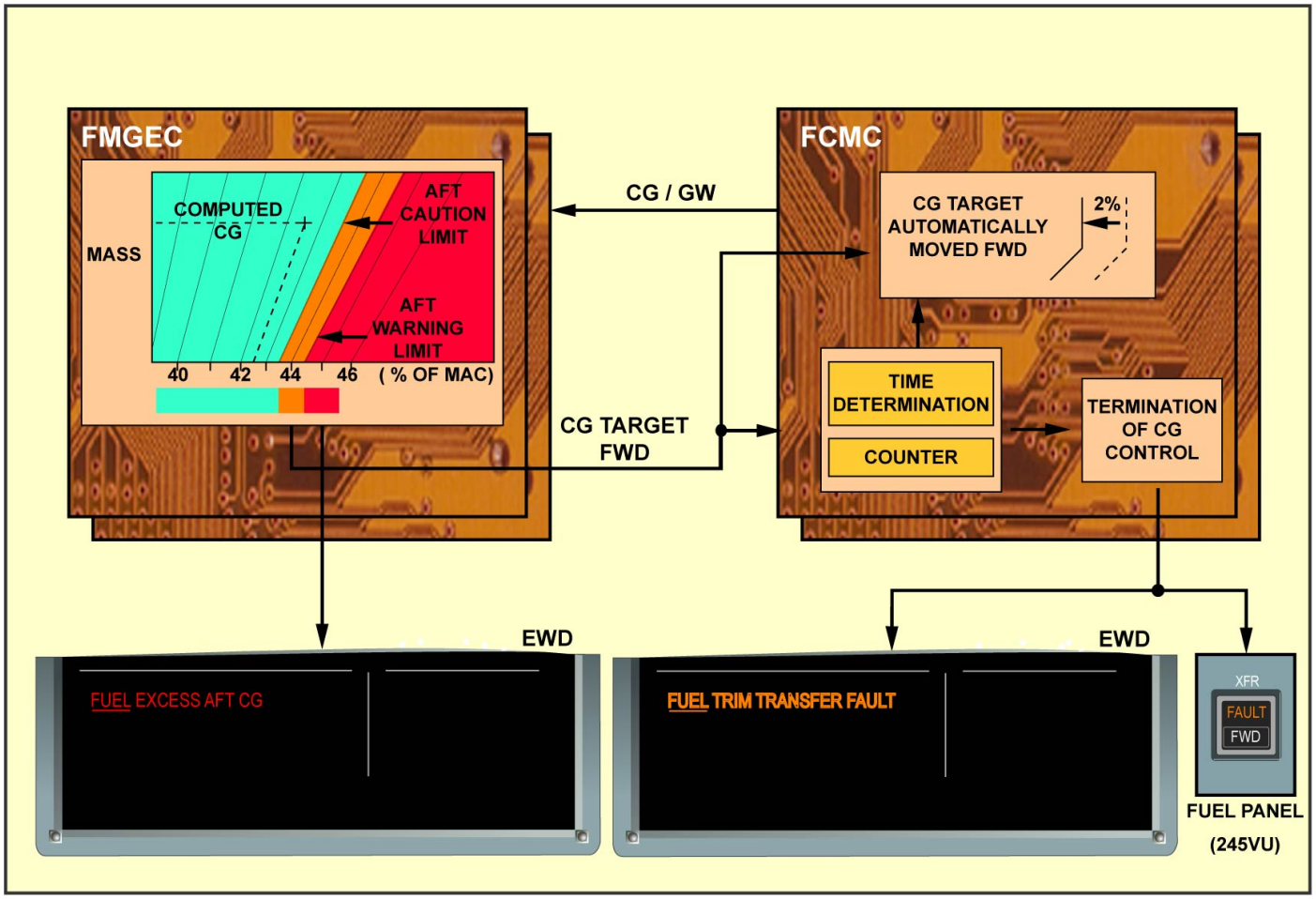

TRIM TRANSFER CONTROL

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TRIM TRANSFER D/O (A330-200)

AFT TRANSFER AUTOMATIC OPERATION

The master FCMC has full control of the A/C CG when the A/C is above FL255, until the A/C descends below FL245. An aft transfer can only start when all of these conditions occur at the same time:
- the calculated CG is less than the target CG minus 1.0% MAC for more than 60 seconds,
- the L/G is retracted,
- the slats are retracted,
- the trim tank is not full,
- an aft transfer is not prevented,
- the inner tanks fuel contents are more than 6250 kg.

The aft transfer stops if one of these conditions occurs:
- the trim tank becomes full,
- the calculated CG is greater than the target CG by 0.5% MAC,
- the fuel quantity in the inner tank decreases to less than 6250 kg,
- the T TK FEED switch is not on AUTO,
- the crew sets the T TANK MODE P/BSW to FWD,
- the jettison system is set to ON,
- the CTR TANK XFR P/BSW is set to MAN,
- the OUTER TK XFR P/BSW is set to MAN,
- the A/C descends below 7468 m,
- the time-to-destination is less than 35 minutes.
- the FQI system shows fuel in the trim surge tank,
- the FQI system shows fuel in the wing surge tank,

Usually only one aft transfer is made during each flight. This transfer stops when the aft CG target is reached or the trim tank is full.

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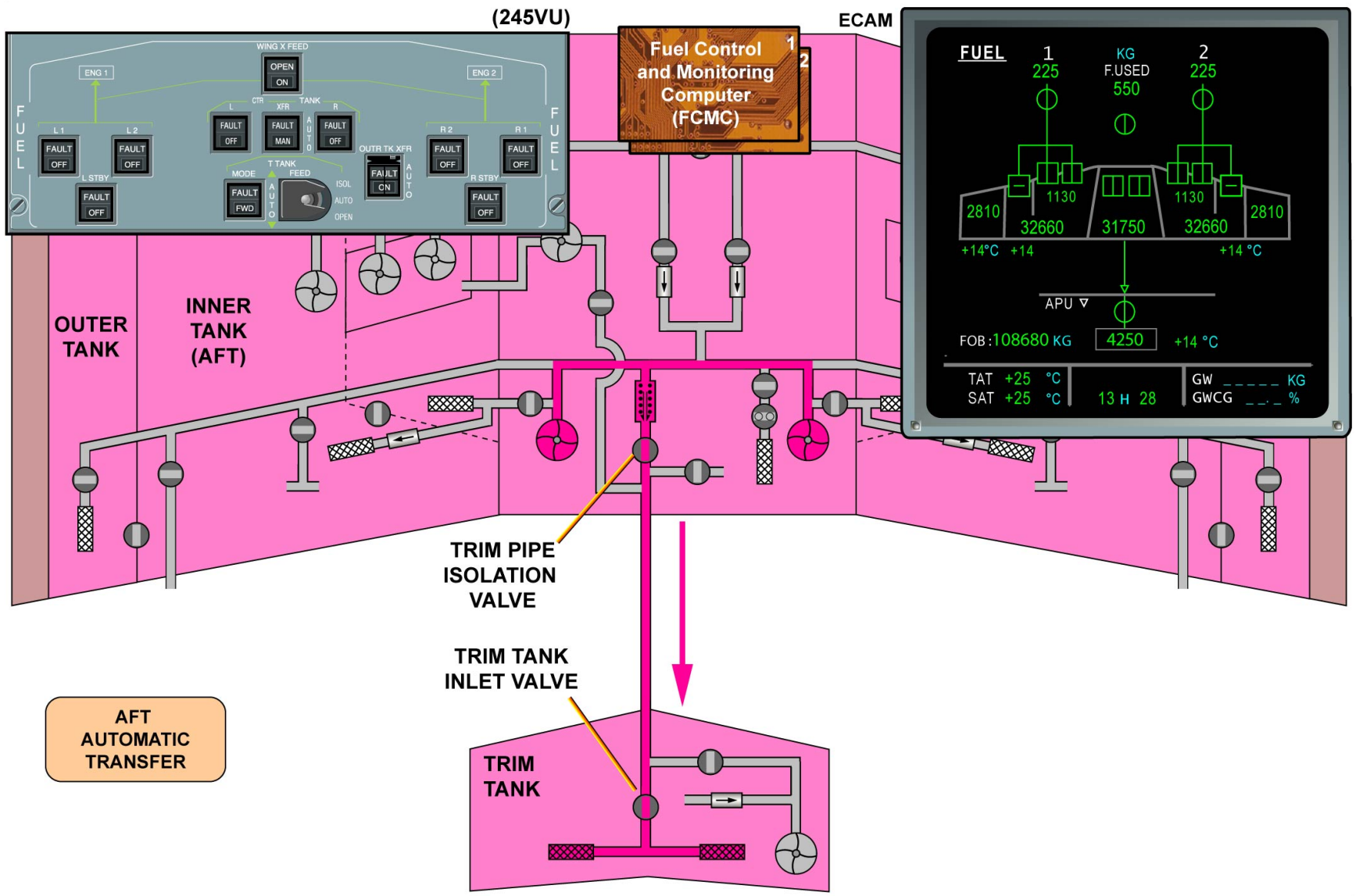

AFT TRANSFER AUTOMATIC OPERATION

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TRIM TRANSFER D/O (A330-200)

AFT TRANSFER AUTOMATIC OPERATION (continued)

CENTER TANK TO TRIM TANK FUEL TRANSFER

The center tank to trim tank fuel transfer uses the fuel pressure of the 2 center left and right aft transfer pumps, the trim pipe isolation valve and the trim tank inlet valve.

When the L or R CENTER TANK XFR P/BSW is set to on, the related transfer pump is able to operate. The selection of one of the two switches also gives the FCMCs control of the center tank to trim tank fuel transfer. Usually the two P/BSWs are set to on at the same time and, when the FCMCs start an aft transfer, they have control of the trim pipe isolation valve and the trim tank inlet valve. The transfer indication is shown on the FUEL ECAM page.

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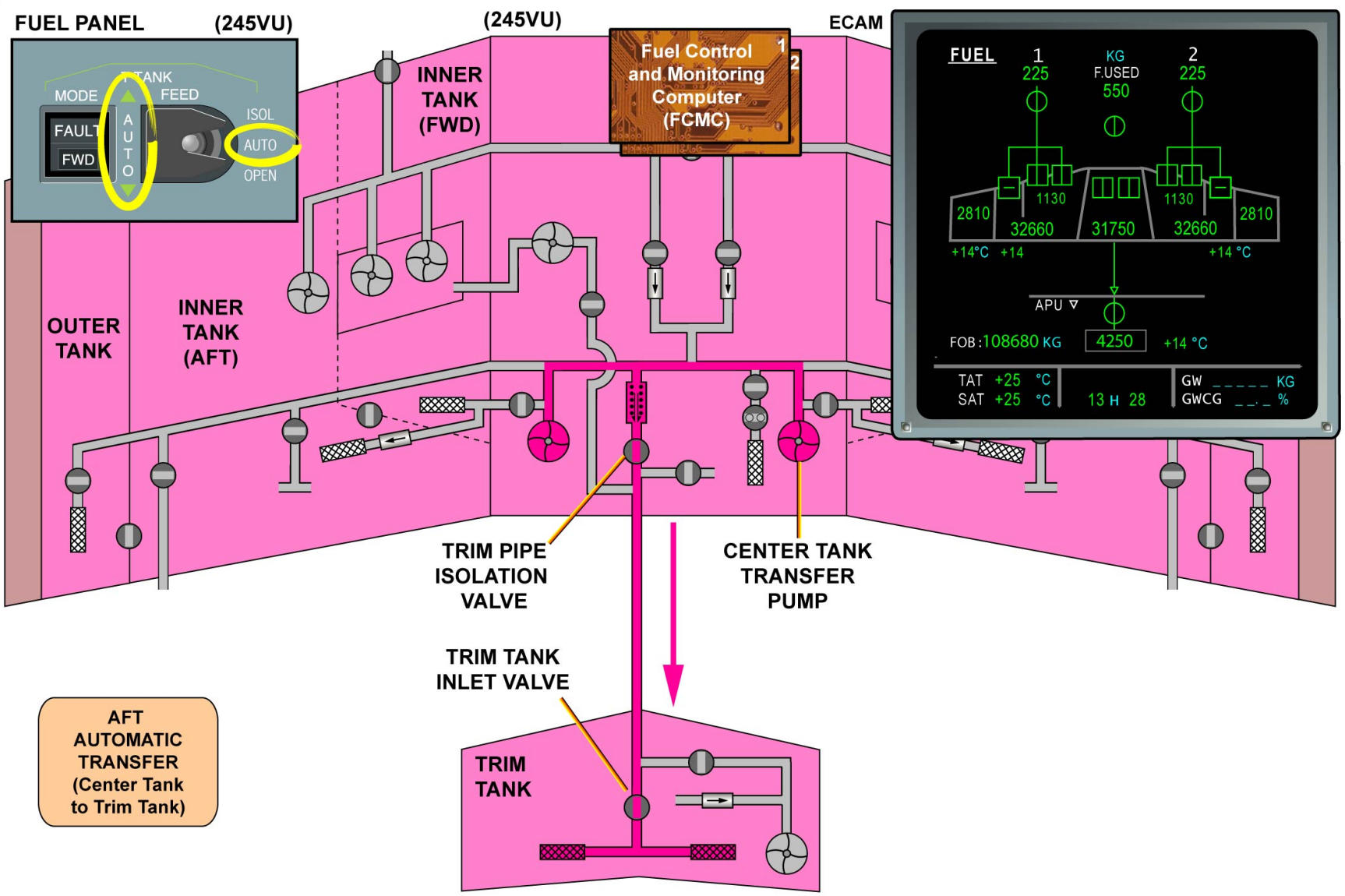

AFT TRANSFER AUTOMATIC OPERATION - CENTER TANK TO TRIM TANK FUEL TRANSFER

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TRIM TRANSFER D/O (A330-200)

AFT TRANSFER AUTOMATIC OPERATION (continued)

CENTER TO TRIM TRANSFER LOGIC

The aft transfer to the trim tank is done from the center tank if not empty.

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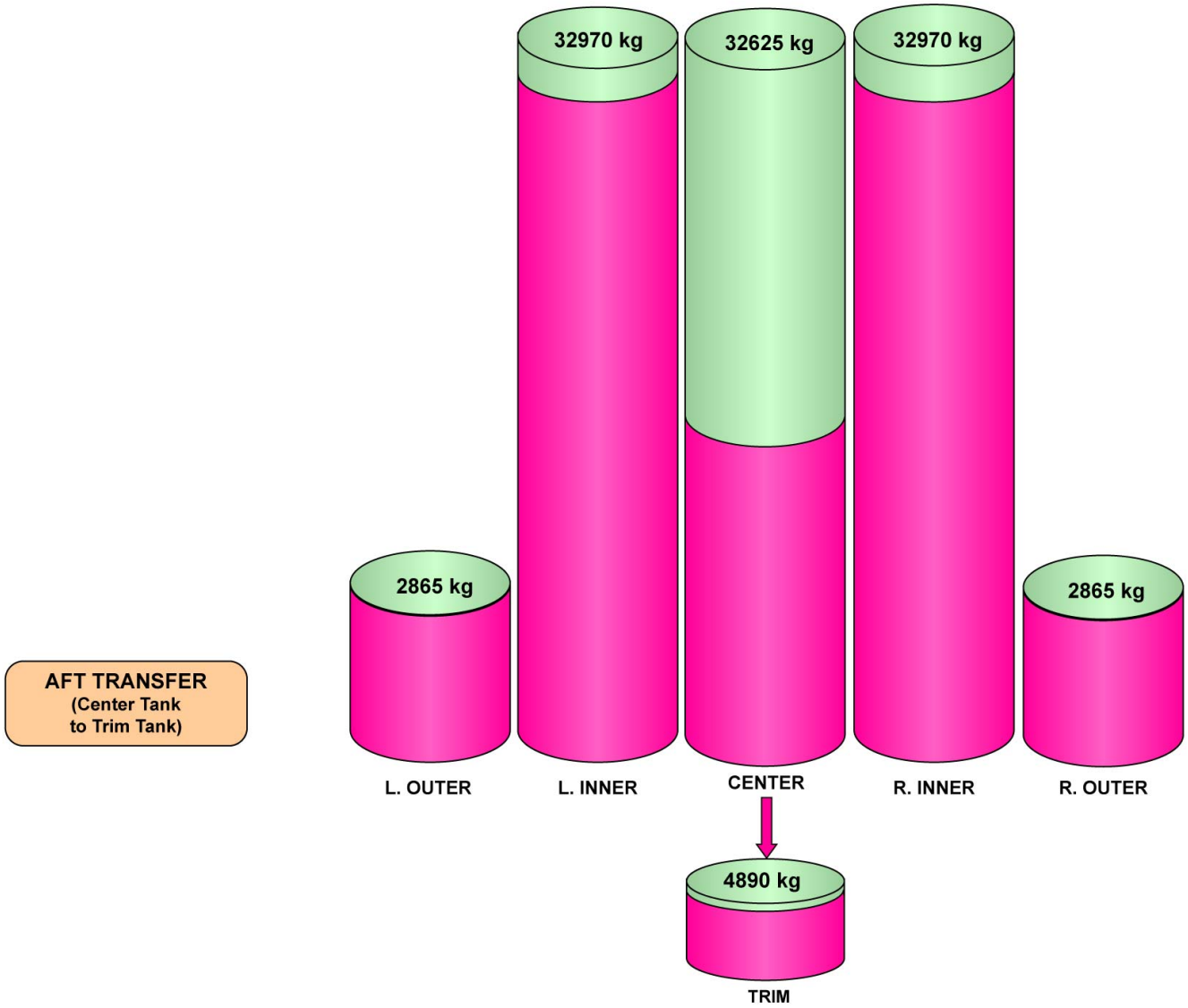

AFT TRANSFER AUTOMATIC OPERATION - CENTER TO TRIM TRANSFER LOGIC

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TRIM TRANSFER D/O (A330-200)

AFT TRANSFER AUTOMATIC OPERATION (continued)

INNER TANKS TO TRIM TANK TRANSFER

The inner tanks to trim tank transfer uses the fuel pressure of the main pumps, the trim pipe isolation valve and the trim tank inlet valve. When the related inner L1 P/BSW is set to on, the related pump is able to operate. The selection of one of the four fuel pumps switches also gives the FCMCs control of the inner tanks to trim tank fuel transfer. Usually the four P/BSWs are set to on at the same time and, when the FCMCs start an aft transfer, the computers have control of the trim pipe isolation valve and the trim tank inlet valve.
The transfer indication is displayed on the FUEL ECAM page.

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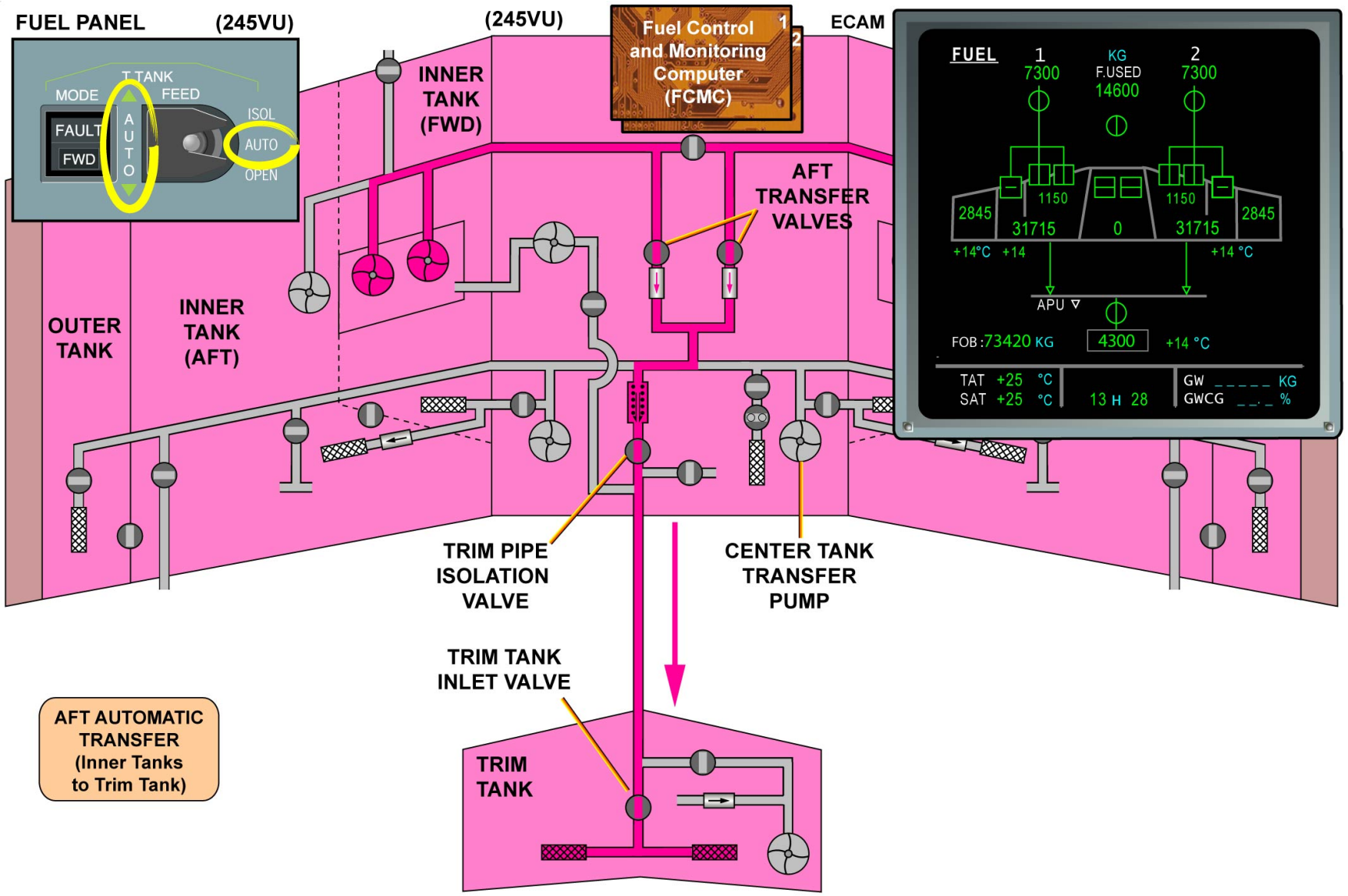

AFT TRANSFER AUTOMATIC OPERATION - INNER TANKS TO TRIM TANK TRANSFER

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TRIM TRANSFER D/O (A330-200)

AFT TRANSFER AUTOMATIC OPERATION (continued)

INNER TANKS TO TRIM TANK TRANSFER LOGIC

When the center tank is empty and the difference between the inner tanks 1 & 2 is more than 500 kg, the AFT transfer will stop on the lightest side, and the related AFT transfer valve will automatically close until fuel balance is restored.

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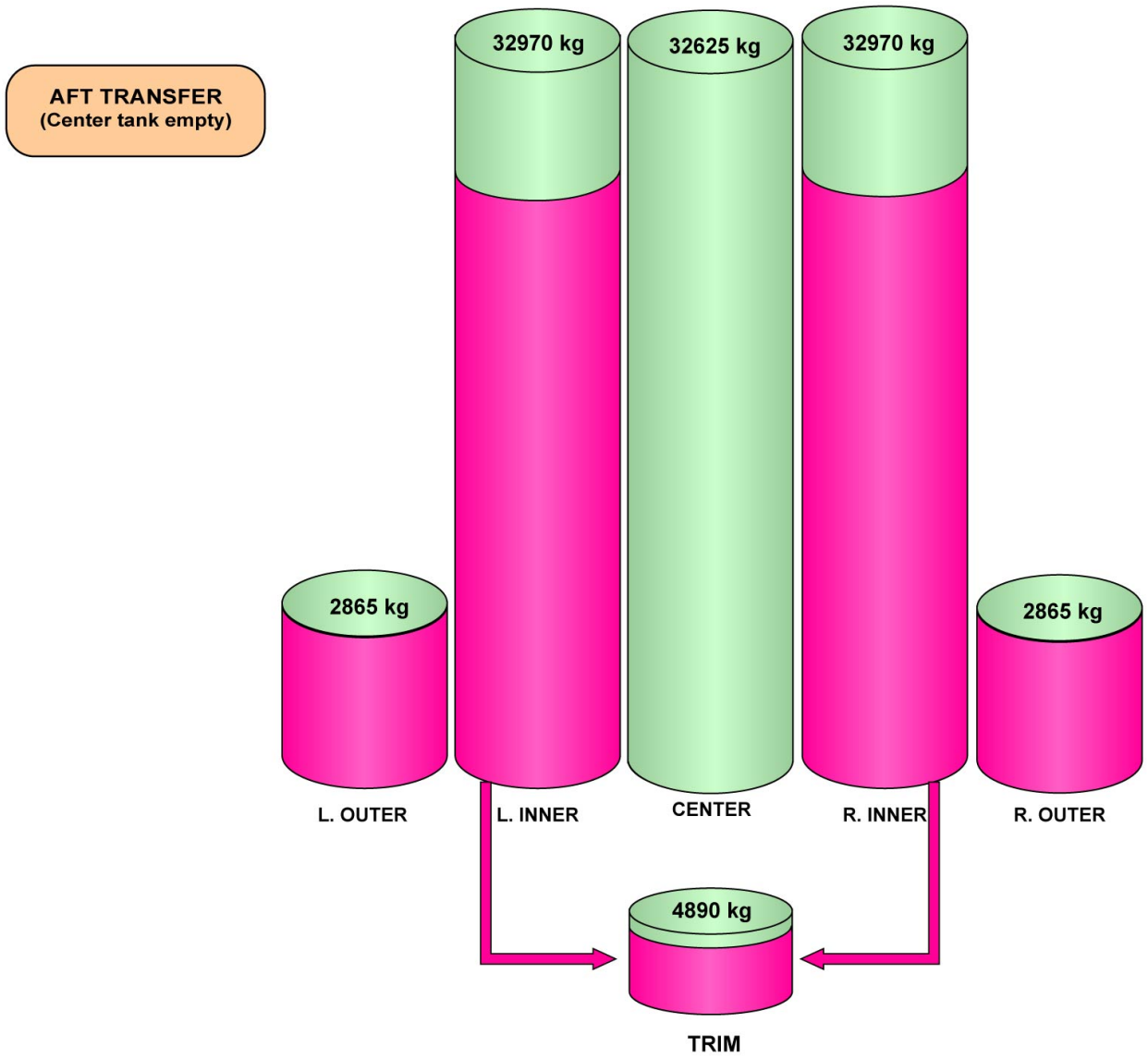

AFT TRANSFER AUTOMATIC OPERATION - INNER TANKS TO TRIM TANK TRANSFER LOGIC

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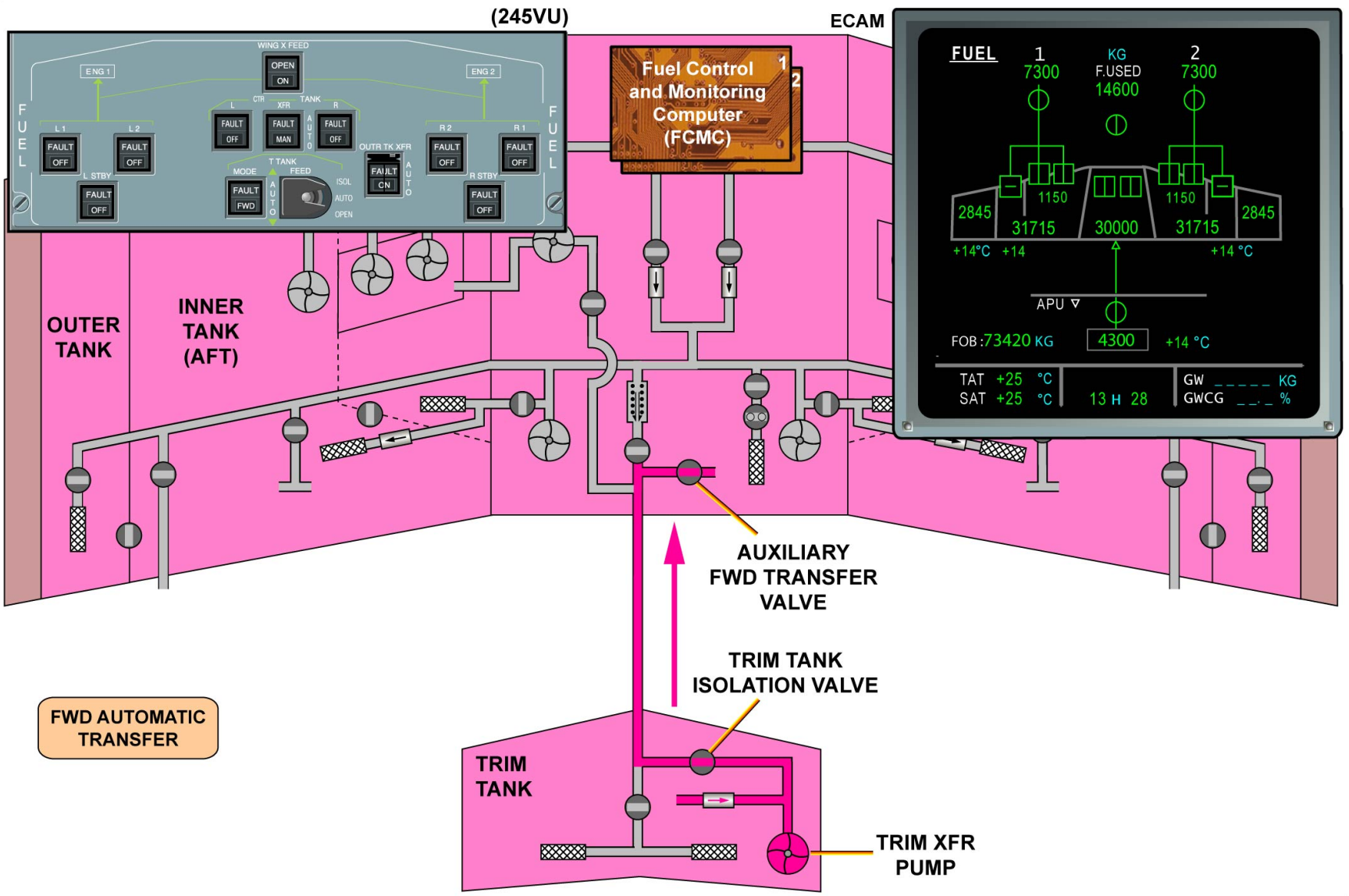
TRIM TRANSFER D/O (A330-200)

FWD TRANSFER AUTOMATIC OPERATION

The master FCMC sends a FWD transfer signal if one of these conditions occurs:
- the calculated CG is greater than the target CG (the FWD transfer continues until the calculated CG is less than the target CG minus 0.5% MAC),
- the fuel contents of one of the two inner tanks decrease to 4000 kg,
- the FCMCs receive a 35 minutes to destination signal,
- the jettison system is set to ON,
- the A/C descends below FL 245.

The FWD transfer stops if one of these conditions occurs:
- one of the inner tanks fuel contents increases to 4000 kg,
- when the L/G lever is selected down,
- when the trim tank is empty.

Trim tank empty determination is made following this process:
- when trim tank low level sensors have been detected dry for more than 60 seconds, the FCMC stops the trim tank pump.



FWD TRANSFER AUTOMATIC OPERATION

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TRIM TRANSFER D/O (A330-200)

FWD TRANSFER AUTOMATIC OPERATION (continued)

TRIM TANK TO CENTER TANK TRANSFER

If the center tank is not empty, the FWD transfer is from the trim tank to the center tank.

The trim tank to the center tank fuel transfer uses the fuel pressure of the trim transfer pump, the trim tank isolation valve and the auxiliary FWD transfer valve.

When the MODE T TK P/BSW is set to on, the related transfer pump is controlled to operate by the FCMCs for water scavenging purposes, provided the trim tank is not empty. When the FCMCs start a FWD transfer, the computers have control of the trim tank isolation valve and the auxiliary FWD transfer valve.

The transfer indication and pumps status are shown on the FUEL ECAM page.

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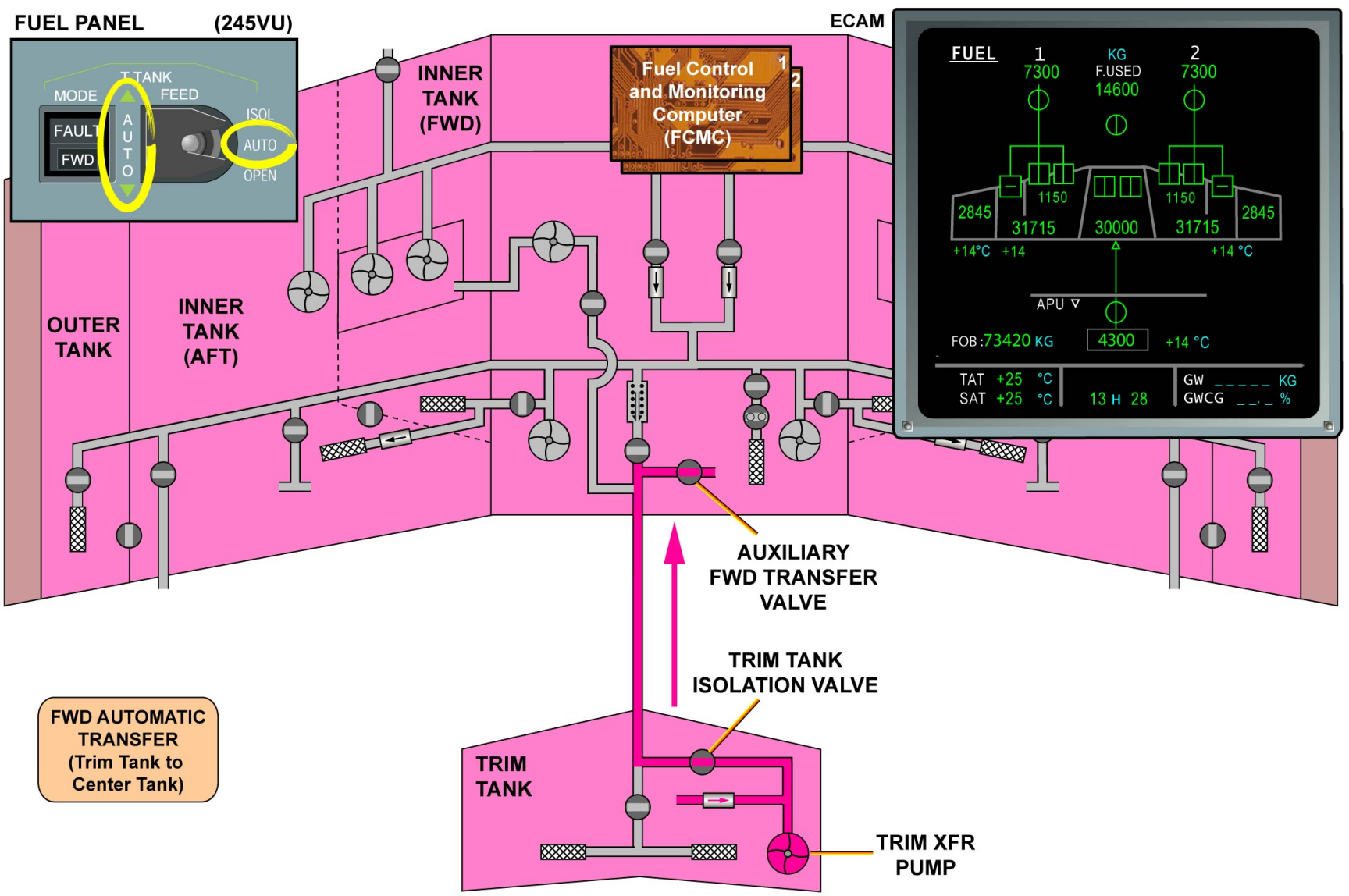

FWD TRANSFER AUTOMATIC OPERATION - TRIM TANK TO CENTER TANK TRANSFER

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TRIM TRANSFER D/O (A330-200)

FWD TRANSFER AUTOMATIC OPERATION (continued)

TRIM TANK TO CENTER TANK FWD TRANSFER LOGIC

When the center tank is not empty, the FWD transfer is done towards the center tank.

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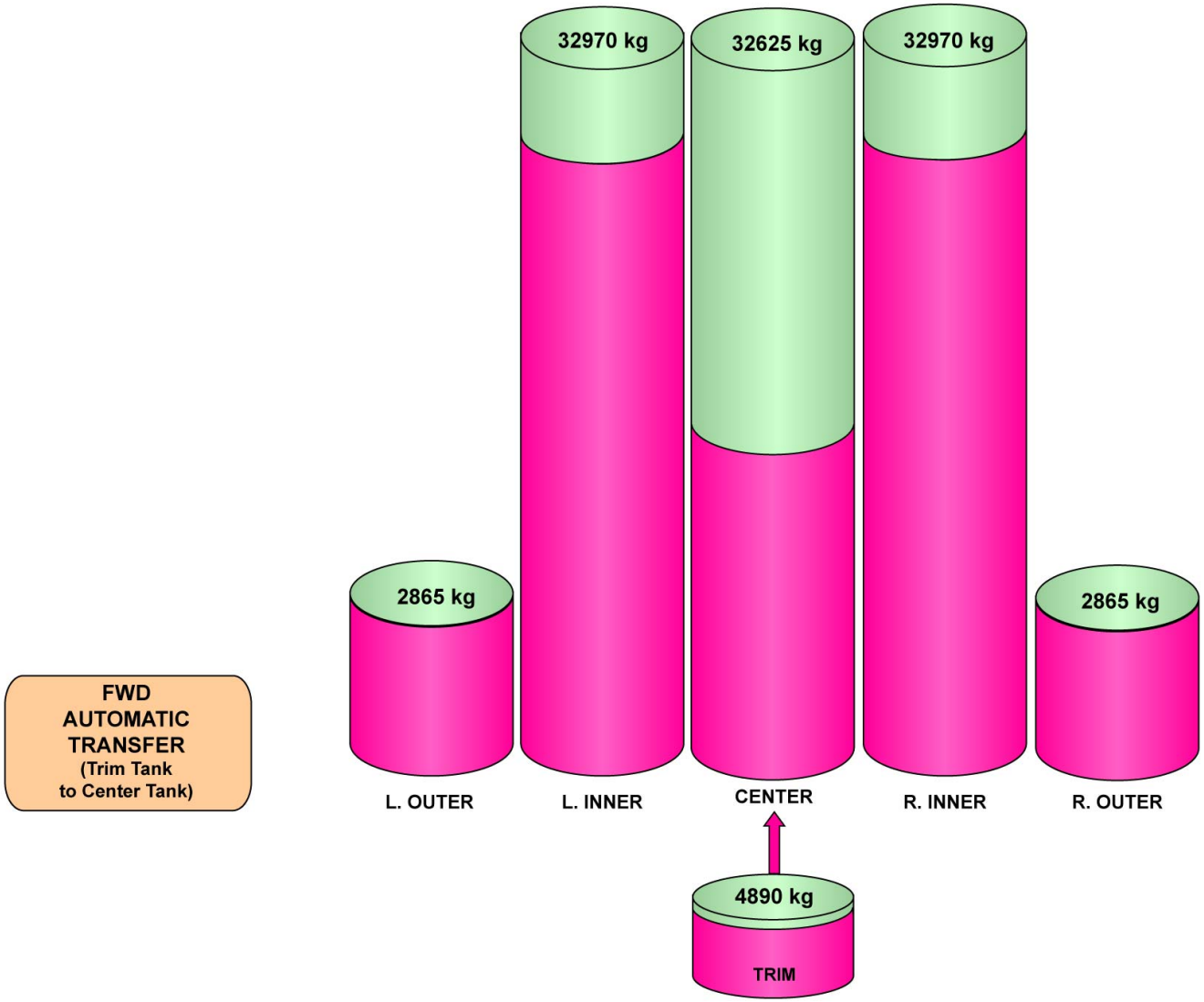

FWD TRANSFER AUTOMATIC OPERATION - TRIM TANK TO CENTER TANK FWD TRANSFER LOGIC

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TRIM TRANSFER D/O (A330-200)

FWD TRANSFER AUTOMATIC OPERATION (continued)

TRIM TANK TO INNER TANKS TRANSFER

If the center tank is empty, the FWD transfer is from the trim tank to the inner tanks.
It uses the fuel pressure of the trim transfer pump, the trim tank isolation valve, the trim pipe isolation valve, the inner tank transfer valve.
When the T TK MODE P/BSW is set to AUTO, the related trim transfer pump is controlled to operate by the FCMCs for water scavenging purposes, provided the trim tank is not empty. Usually, when the FCMCs start a FWD transfer, the computers have control of the trim tank isolation valve, the trim pipe isolation valve, the auxiliary refuel valve and the inner transfer valves.
The transfer indication and pumps status are shown on the FUEL ECAM page.
The trim transfer pump stops when one of these conditions occurs:
- the aircraft is in flight and the landing gear is extended,
- there is less than 200 kg of fuel in trim tank and the trim tank lo-level sensor id dry for more than 60 seconds,
- the trim transfer pump pressure-switch has low pressure for more than 10 minutes.

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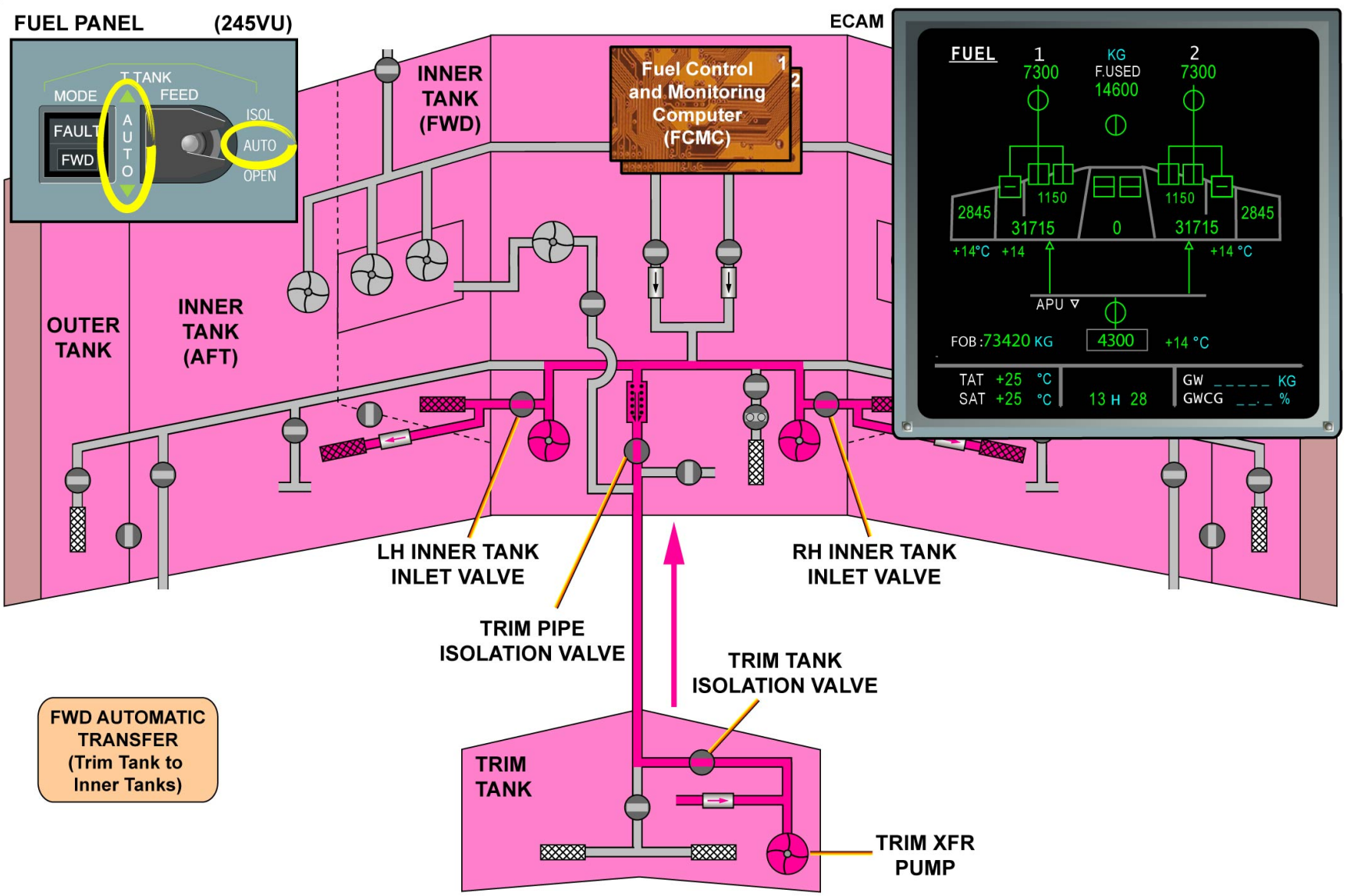

FWD TRANSFER AUTOMATIC OPERATION - TRIM TANK TO INNER TANKS TRANSFER

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TRIM TRANSFER D/O (A330-200)

FWD TRANSFER AUTOMATIC OPERATION (continued)

TRIM TANK TO INNER TANKS FWD TRANSFER LOGIC

When the center tank is empty, the FWD transfer is done towards the inner tanks.

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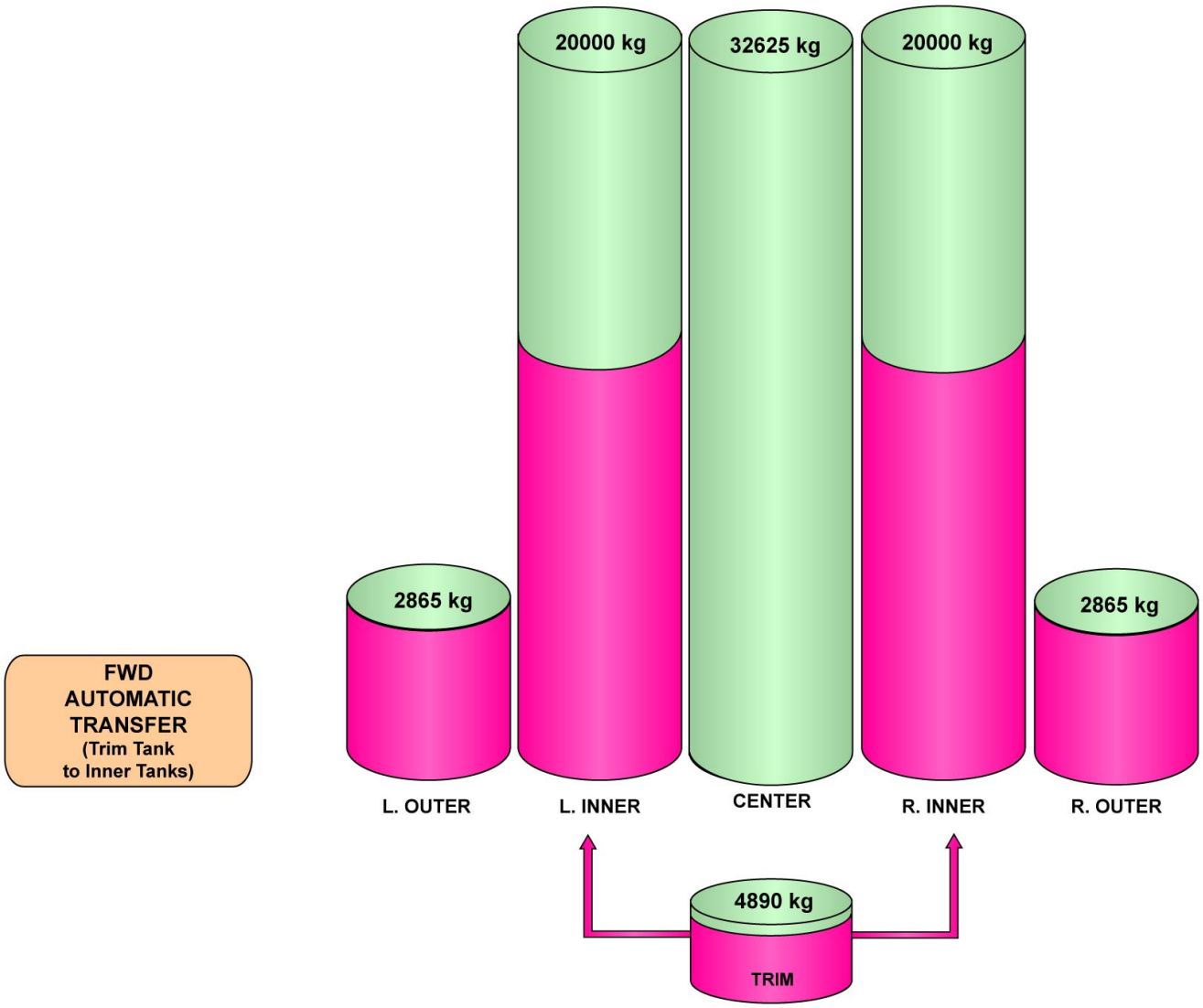

FWD TRANSFER AUTOMATIC OPERATION - TRIM TANK TO INNER TANKS FWD TRANSFER LOGIC

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TRIM TRANSFER D/O (A330-200)

MANUAL OPERATION

MODE "FWD" P/B SELECTION

When a failure is detected during the automatic CG control the FCMC triggers the FAULT light lighting on the MODE T TK P/BSW.
When the MODE T TK P/BSW is set to FWD, the FWD light comes on white, the automatic FCMC CG control stops and a manual FWD transfer into the center tank starts. The FWD transfer has to be monitored to make sure that the center tank is not overfilled, since the center tank high level protection is not active.
The following components are controlled by wiring:
- the trim transfer pumps to run,
- the trim pipe isolation valve to close,
- the auxiliary FWD transfer and trim tank isolation valves to open.

When the trim tank becomes empty, the trim pumps have to be switched off from the related P/BSWs since automatic shut-off is not active.

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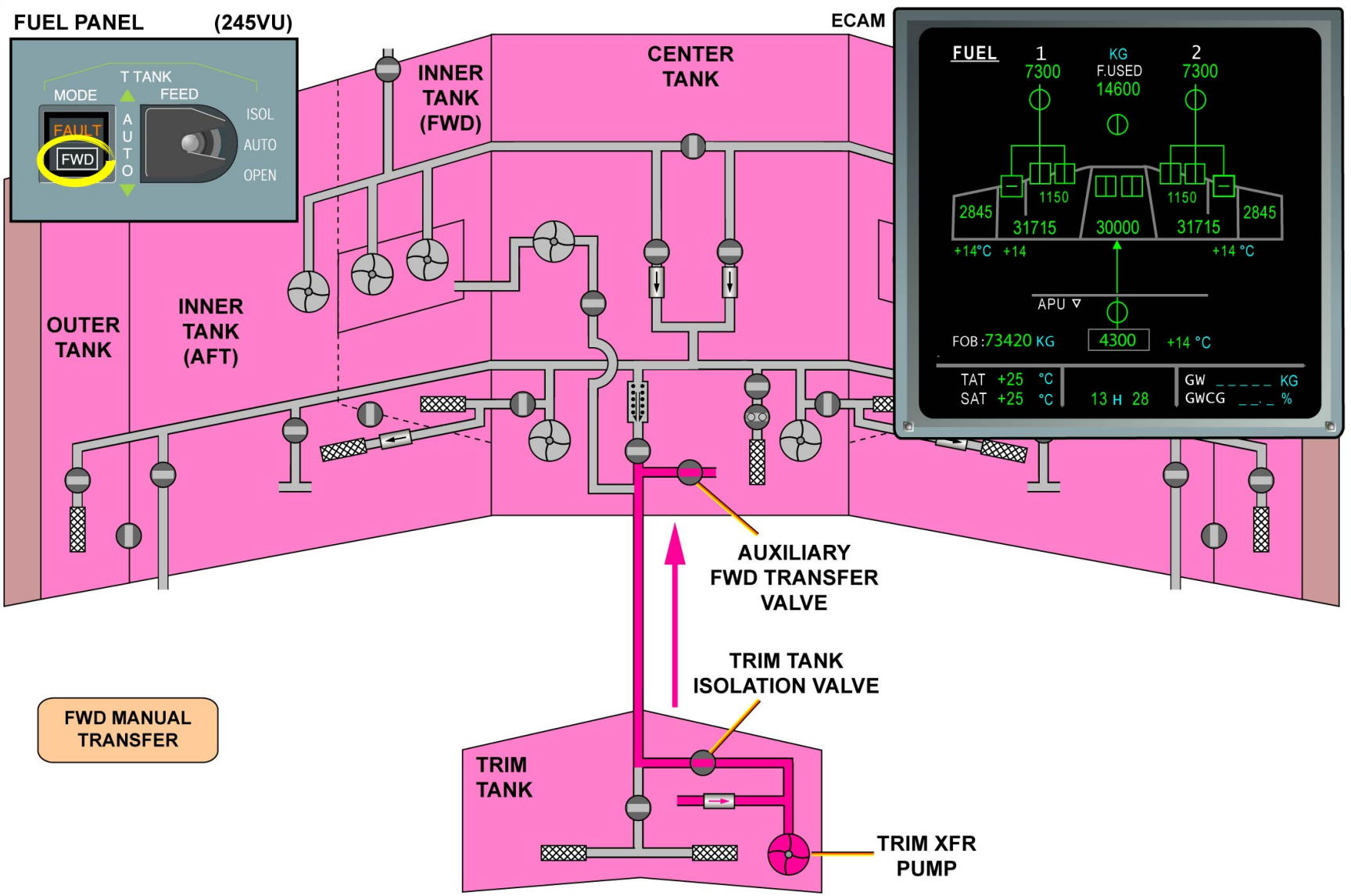

MANUAL OPERATION - MODE "FWD" P/B SELECTION

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TRIM TRANSFER D/O (A330-200)

MANUAL OPERATION (continued)

TRIM TANK FEED SWITCH SELECTIONS

The T TANK FEED switch has three positions AUTO, ISOL and OPEN.
AUTO is the usual position of the switch, which gives the FCMCs full control of the trim transfer system, provided that the "FWD" mode switch is in the OFF position.
In an abnormal situation, following an ECAM warning, trim transfer system isolation can be requested by selecting the T TK FEED switch to ISOL. In this position, the switch overrides the FCMC trim transfer control and the manual FWD transfer P/BSW.
By the wiring, the following valves are controlled to close:
- the trim tank inlet,
- the trim tank isolation,
- the auxiliary FWD transfer,
- the trim pipe isolation,

causing the trim pipe to be isolated at both ends.

NOTE: Note : If T TK FEED switch is set to ISOL, it is still possible to use the APU.

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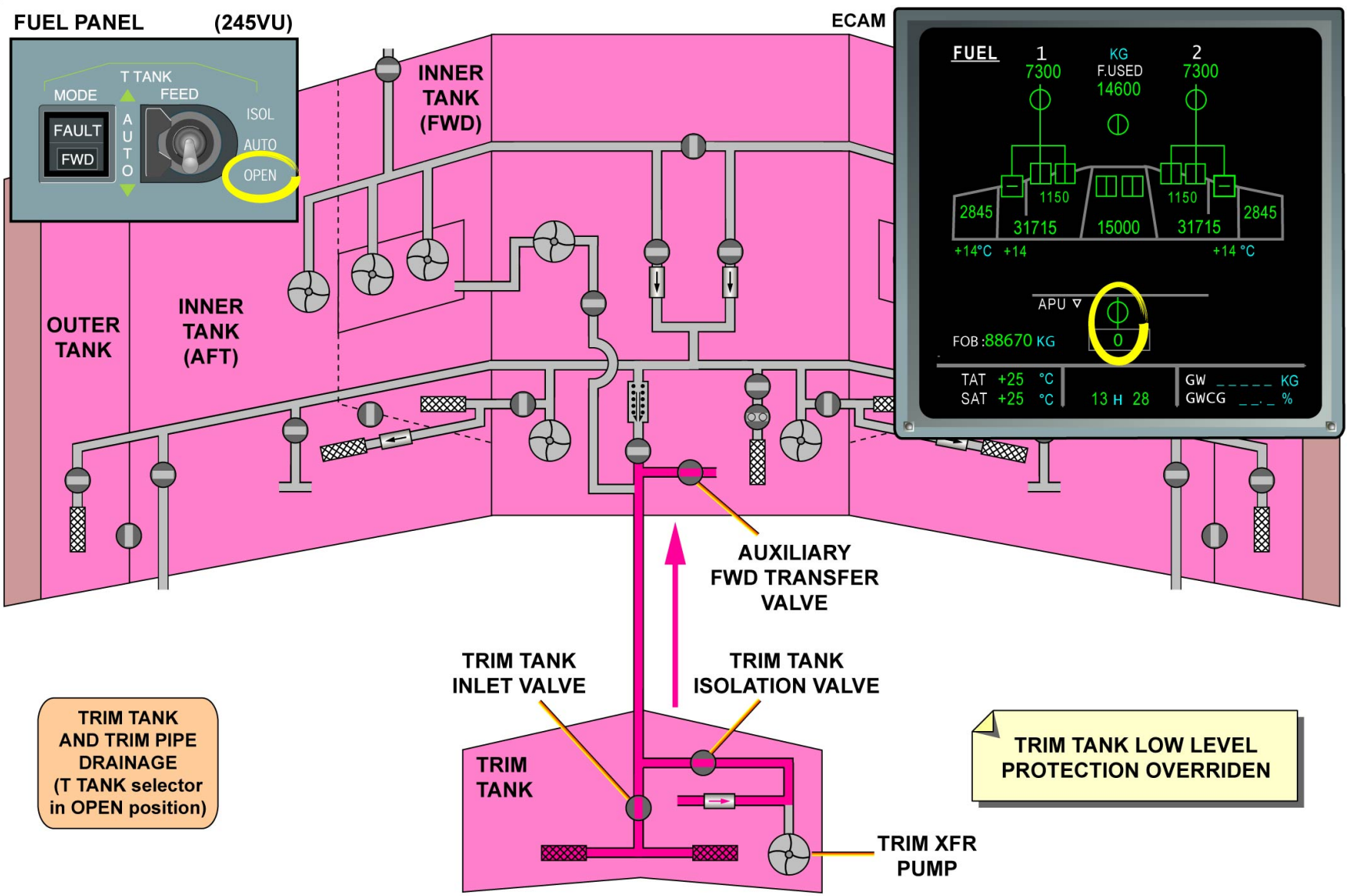

MANUAL OPERATION - TRIM TANK FEED SWITCH SELECTIONS

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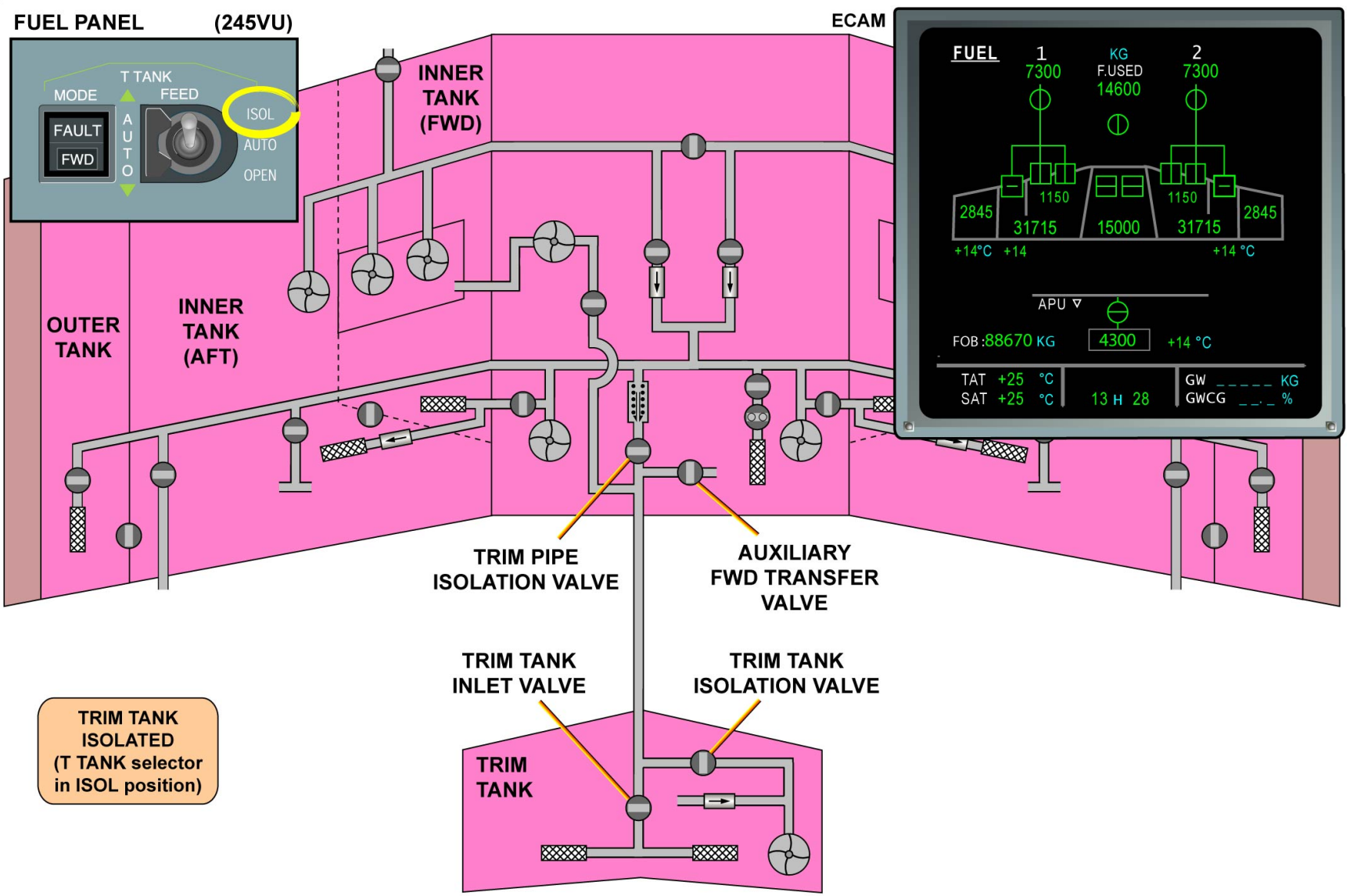

MANUAL OPERATION - TRIM TANK FEED SWITCH SELECTIONS

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TRIM TRANSFER D/O (A330-300)

GENERAL

The trim transfer system controls the Center of Gravity (CG) of the A/C during flight in order to reduce the THS aerodynamic drag and consequently to minimize the fuel consumption.
The Fuel Control and Monitoring Computers (FCMCs) calculate the CG of the A/C and compare the result to a memorized target value. If necessary, the FCMCs then make a decision to move fuel aft or FWD to control the CG. Usually only one aft transfer is made during each flight. But, as the fuel burns, many small FWD transfers are made.
The ECAM gives trim transfer system information to the crew.

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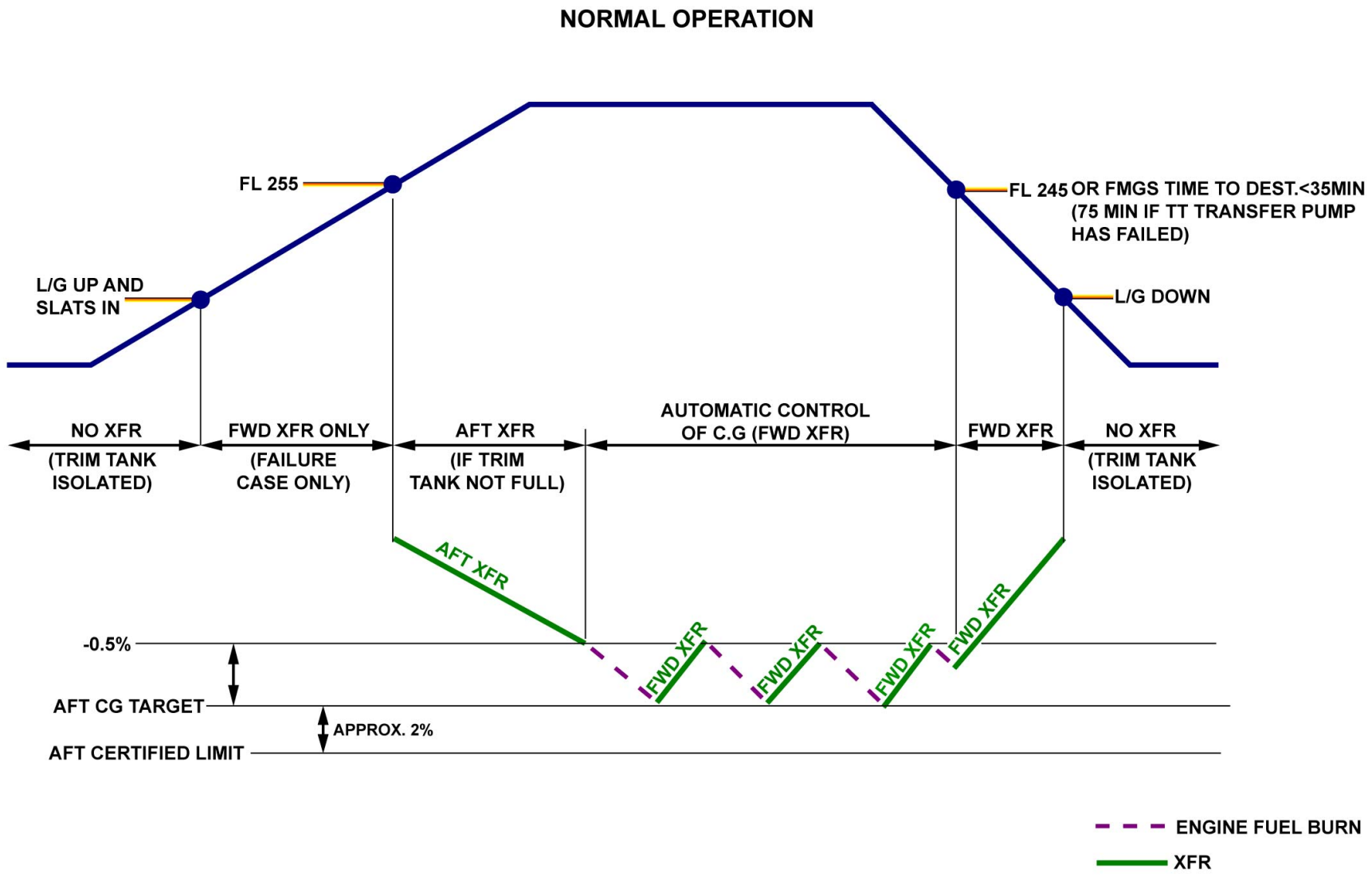
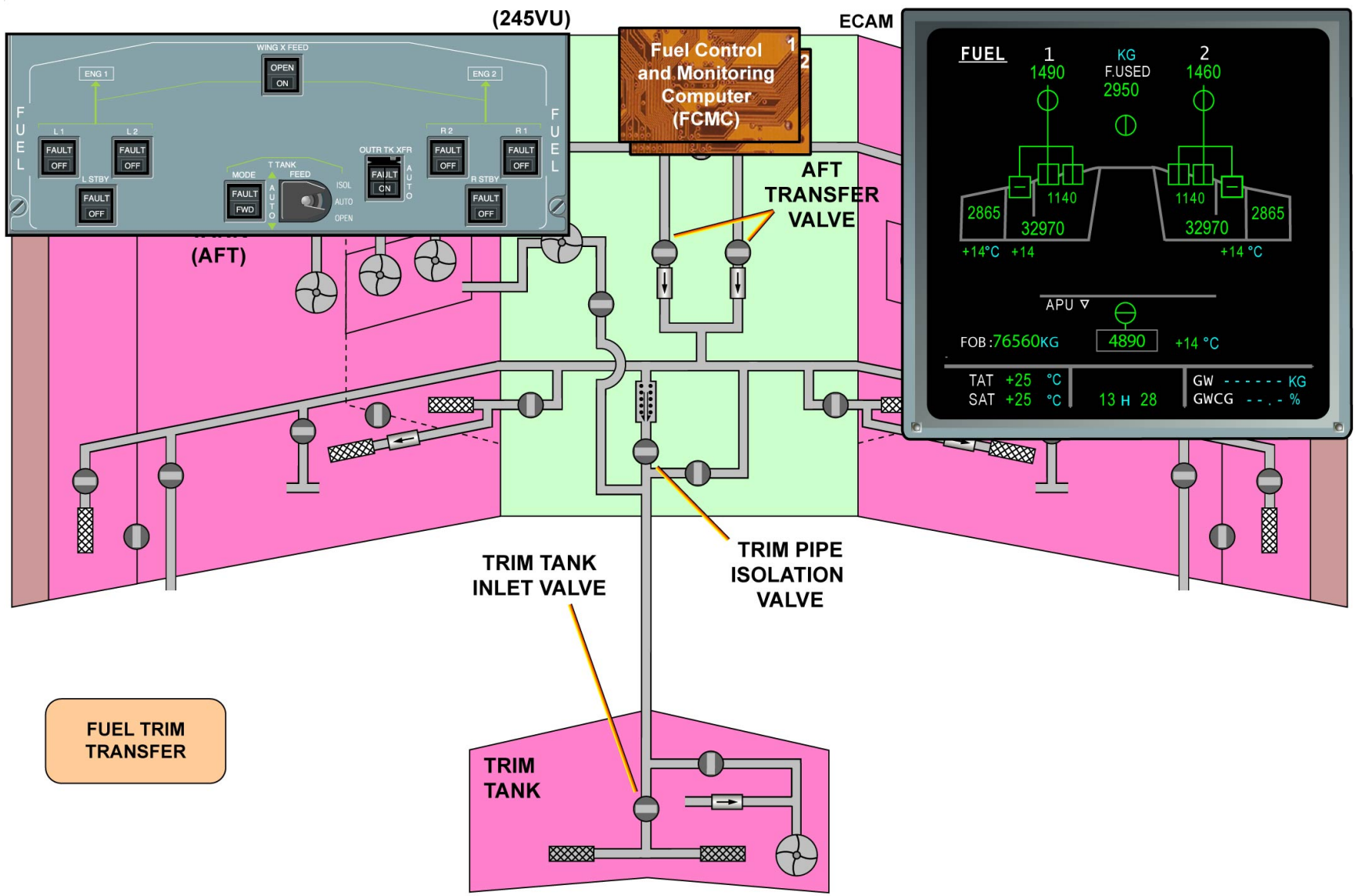

NORMAL OPERATION
FL 255
FL 245 OR FMGS TIME TO DEST.<35MIN
(75 MIN IF TT TRANSFER PUMP
HAS FAILED)
L/G UP AND
SLATS IN
L/G DOWN
NO XFR
(TRIM TANK
ISOLATED)
FWD XFR ONLY
(FAILURE
CASE ONLY)
AFT XFR
(IF TRIM
TANK NOT FULL)
AUTOMATIC CONTROL
OF C.G (FWD XFR)
FWD XFR
NO XFR
(TRIM TANK
ISOLATED)
AFT XFR
FWD XFR
FWD XFR
FWD XFR
FWD XFR
-0.5%
AFT CG TARGET
APPROX. 2%
AFT CERTIFIED LIMIT
ENGINE FUEL BURN
XFR

GENERAL


(245VU)
ECAM
Fuel Control and Monitoring Computer (FCMC)
1
2
WING X FEED
OPEN
ON
ENG 1
ENG 2
FUEL
L 1
L 2
R 2
R 1
FAULT
OFF
L STBY
R STBY
T TANK
MODE
FEED
FWD
AUTO
ISOL
OUTR TK XFR
ON
OPEN
(AFT)
AFT TRANSFER VALVE
FUEL
1
KG
2
1490
F.USED
2950
1460
2865
1140
32970
+14°C
+14
+14 °C
APU
FOB :76560KG
4890
TAT +25 °C
SAT +25 °C
13 H 28
GW ------ KG
GWCG --.- %
TRIM TANK INLET VALVE
TRIM PIPE ISOLATION VALVE
FUEL TRIM TRANSFER
TRIM TANK

GENERAL

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G9409341 - GAUT0T0 - FM28D7000000009

TRIM TRANSFER D/O (A330-300)

DESCRIPTION

TRIM PIPE ISOLATION VALVE, AUXILIARY FORWARD TRANSFER VALVE AND ACTUATORS

A trim pipe isolation valve and an auxiliary FWD transfer valve, both of the ball valve type, are installed in the center tank area and attached to the FWD face of the rear spar in the center tank area. The trim pipe isolation valve is installed at the FWD end of the fuel supply pipe to the trim tank to control all the aft transfers and the FWD transfers to the wings. The auxiliary FWD transfer valve is installed in the trim pipe, in the center fuselage area, to control the fuel flow from the trim tank to the inner tank.
Each one is operated with a single electrical motor actuator attached to the rear face of the center tank rear spar and equipped with a visual position indicator.

TRIM TANK ISOLATION VALVE AND ACTUATOR

A trim tank isolation valve, of the ball valve type, is installed in the fuel line from the trim tank to the trim pipe in order to control the FWD transfer of fuel from the trim tank to the trim pipe. It is installed at the bottom of the trim tank. It is operated with an electrical motor actuator attached to the bottom skin of the trim tank and equipped with a visual position indicator.

TRIM TANK INLET VALVE AND ACTUATOR

A trim tank inlet valve, of the ball valve type, is installed in the fuel supply pipe to the trim tank in order to control the flow of fuel into the trim tank. The valve is in the trim tank and is attached to the bottom skin of the trim tank. It is operated with an electrical motor actuator attached to the bottom skin of the trim tank and equipped with a visual position indicator.

AFT TRANSFER PUMPS AND CANISTERS

The inner tanks pumps supply fuel to the engines, the trim transfer and the jettison system. Each pump is driven by a 3-phase 115 VAC motor and is enclosed in a canister attached to the tank bottom skin. Pumps and canisters are all assembled in the same way and are interchangeable.

TRIM TRANSFER PUMP, PRESSURE SWITCH AND JET PUMPS

The fuel trim transfer pump is installed horizontally and attached to the FWD Right side face of the trim tank. The pump unit is enclosed in a removable sealing case externally bolted onto the trim tank FWD face. The impeller type pump element is driven by a 3-phase 115 VAC motor and installed in the pump housing.
A 6 to 8 psi pump low pressure switch is also installed on the pump housing. Inside the tank, there are 2 outlets on the pump housing which connect the pump to the trim tank and to the trim pipe.

TRANSFER PUMPS CHECK VALVES

The outlet pipe from the fuel transfer pump contains a check valve. It prevents an opposite fuel flow through the pump when it is not in operation.

TRIM TRANSFER PUMP PRESSURE SWITCH

The trim transfer pump has an output monitoring LP switch which operates between 6 and 8 psi depending on pressure increase or decrease.

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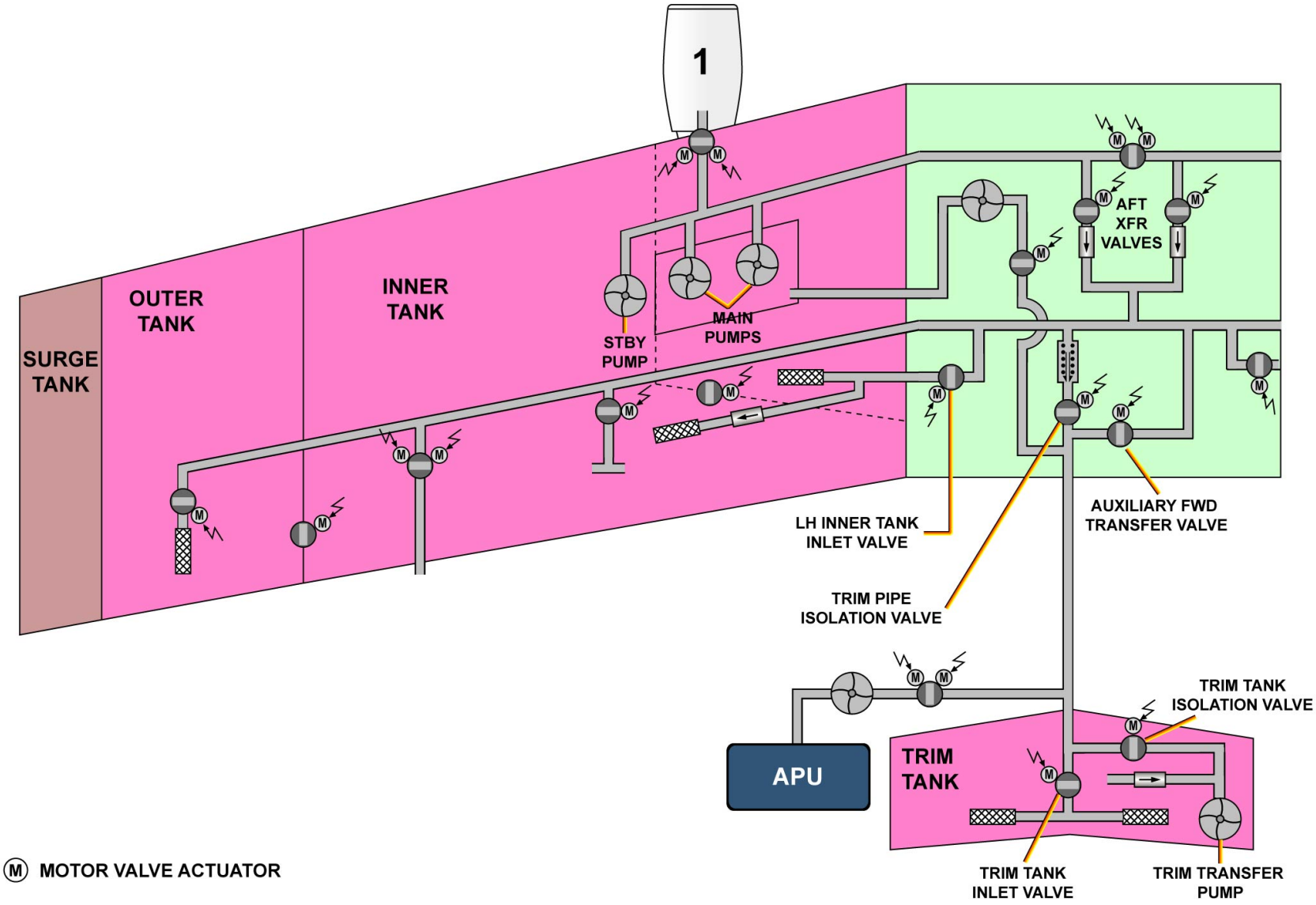

DESCRIPTION - TRIM PIPE ISOLATION VALVE, AUXILIARY FORWARD TRANSFER VALVE AND ACTUATORS ... TRIM TRANSFER PUMP PRESSURE SWITCH

TRIM TRANSFER D/O (A330-300)

TRIM TRANSFER CONTROL

Before each flight, the crew inputs the A/C Zero Fuel Center of Gravity (ZFCG) and Zero Fuel Weight (ZFW) data into the Flight Management Guidance and Envelope Computers (FMGECs) via the MCDU. The two FMGECs independently transmit this data to the FCMCs.
Each FCMC uses the ZFW from the FMGECs and the tanks fuel weight to calculate the A/C Gross Weight (GW). This GW is output to the ECAM FUEL page, and is used, in the FCMCs, to obtain the target CG from the memorized CG versus percentage of Mean Aerodynamic Chord (MAC) CG table.
In the same time, the FCMCs calculate the fuel weight CG using the FQI, the pitch, roll and acceleration data from the Air Data Inertial Reference Units (ADIRUs) 1 and 2, and the THS position from the Flight Control Data Concentrators (FCDCs). Then, with the ZFWCG transmitted by the FMGECs and the fuel weight CG, the FCMCs calculate the Gross Weight Center of Gravity (GWCG). This GWCG is output to the ECAM FUEL page. The FCMCs, in their transfer logic part, compare the GWCG with the target CG to determine if a FWD transfer or an aft transfer is needed.
CG control during automatic operation:
The FMGEC independently monitors the CG of the A/C. If it detects that the A/C CG is too far aft, it sends a signal "CG target FWD" to the FCMCs. The master FCMC moves the target CG forward 2.0% MAC. This is latched until the end of the flight. If the FMGEC detects that the CG is still aft of the new target CG, it sends a signal to the FCMCs. The FCMCs then move the target CG forward 0.5% MAC for 10 minutes. After 10 minutes the system goes back to normal operation.
This procedure can occur twice more until the target CG is first 4.0% then 6.0% MAC forward of the initial position.
If the error is detected again, the FCMC stops the CG control and shows an ECAM warning to the crew. The crew then manually sets a forward transfer.

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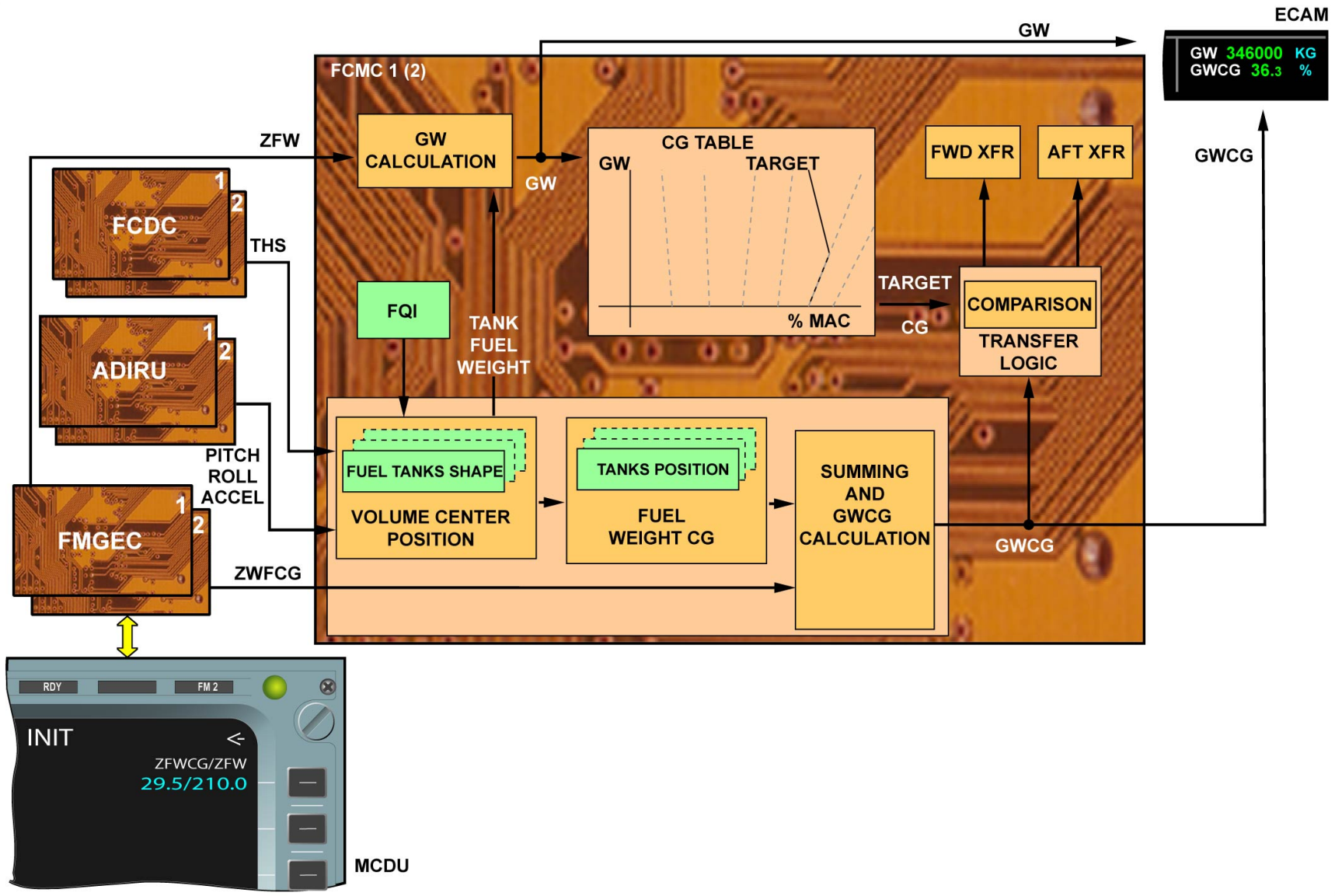

TRIM TRANSFER CONTROL

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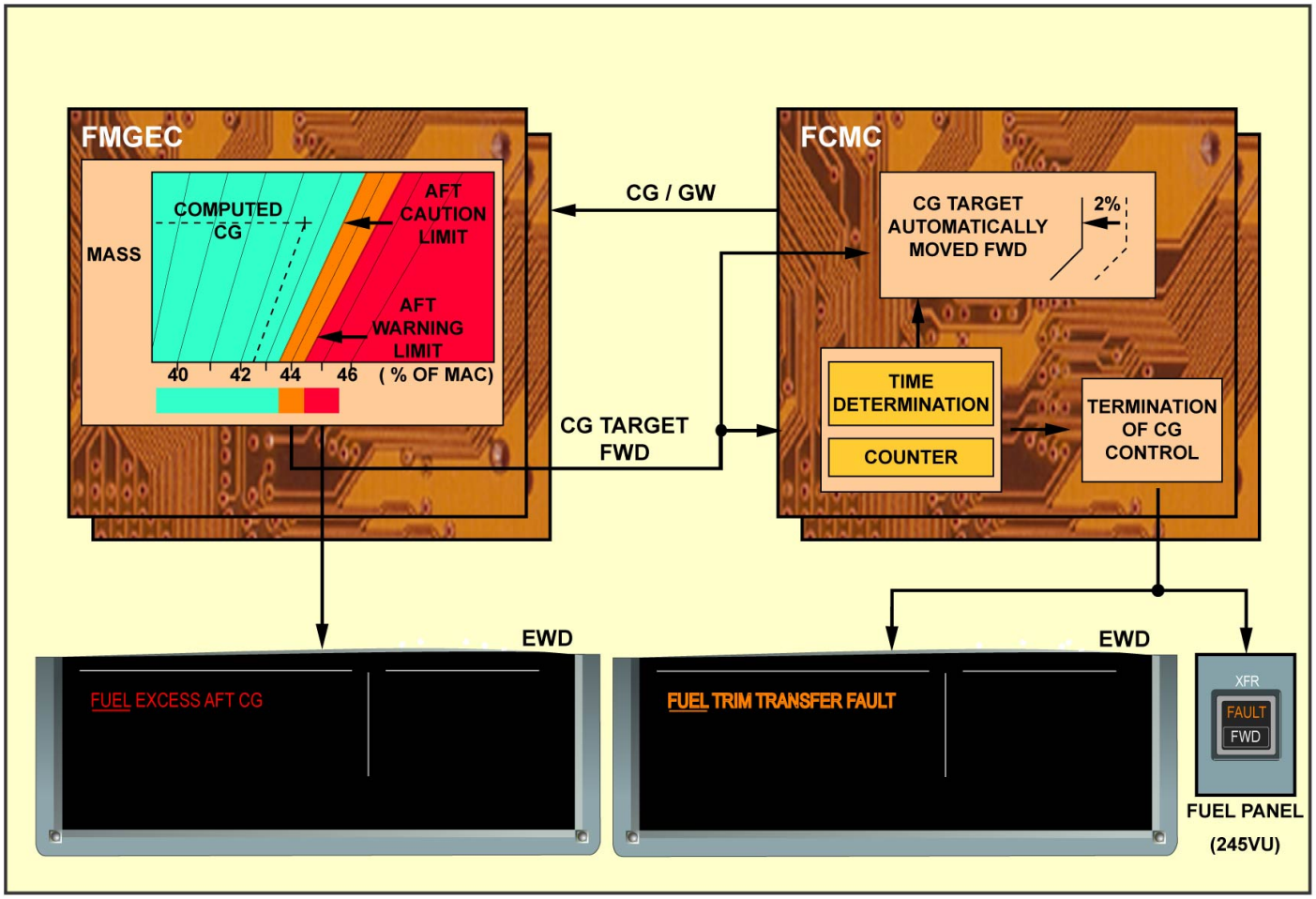

TRIM TRANSFER CONTROL

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TRIM TRANSFER D/O (A330-300)

AFT TRANSFER AUTOMATIC OPERATION

The master FCMC has full control of the A/C CG when the A/C is above FL255, until the A/C descends below FL245. An aft transfer can only start when all of these conditions occur at the same time:
- the calculated CG is less than the target CG minus a constant moment,
- the L/G is retracted,
- the slats are retracted,
- the trim tank is not full,
- an aft transfer is not prevented,
- the inner tanks fuel contents are more than 6250 kg.

The aft transfer stops if one of these conditions occur:
- the trim tank becomes full,
- the calculated CG is greater than the target CG by 0.5% MAC,
- the fuel quantity in the inner tank decreases to less than 6250 kg,
- the T TK FEED switch is not on AUTO,
- the crew sets the T TANK MODE P/BSW to FWD,
- the jettison system is set to ON,
- the CTR TANK XFR P/BSW is set to MAN,
- the OUTER TK XFR P/BSW is set to MAN,
- the A/C descends below FL245,
- the time-to-destination is less than 35 minutes.
- the FQI system shows fuel in the trim surge tank,
- the FQI system shows fuel in the wing surge tank,

Usually only one aft transfer is made during each flight. This transfer stops when the aft CG target is reached or the trim tank is full.

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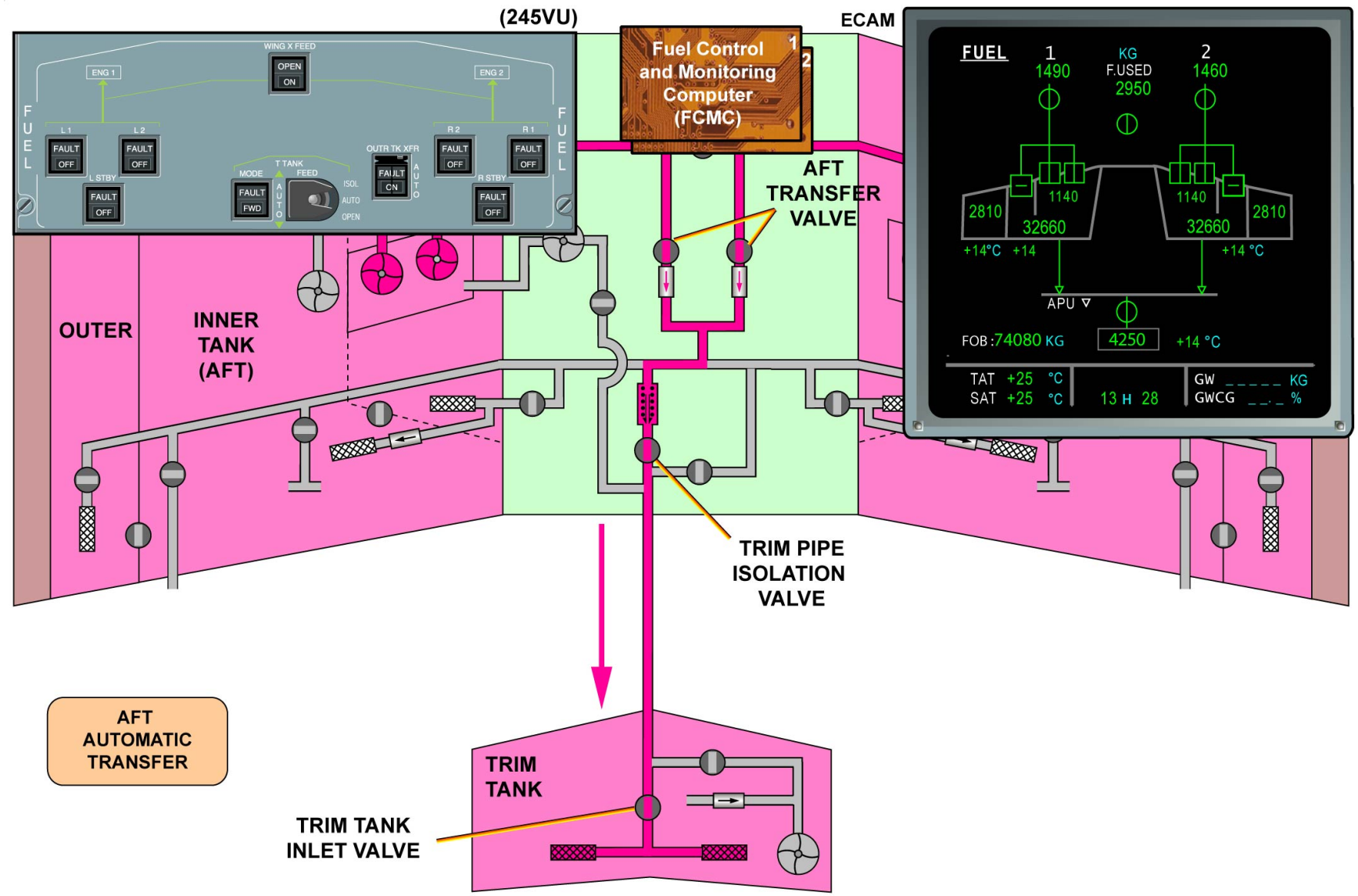

AFT TRANSFER AUTOMATIC OPERATION

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TRIM TRANSFER D/O (A330-300)

AFT TRANSFER AUTOMATIC OPERATION (continued)

INNER TANKS TO TRIM TANK TRANSFER

The inner tanks to trim tank transfer uses the fuel pressure of the main pumps, the trim pipe isolation valve and the trim tank inlet valve. When the related inner L1 P/BSW is set to on, the related transfer pump is able to operate. The selection of one of the four main fuel pump P/B switches also gives the FCMCs control of the inner tanks to trim tank fuel transfer. Usually the four P/BSWs are set to on at the same time and, when the FCMCs start an aft transfer, the computers have control of the trim pipe isolation valve and the trim tank inlet valve.
The transfer indication is shown on the FUEL ECAM page.

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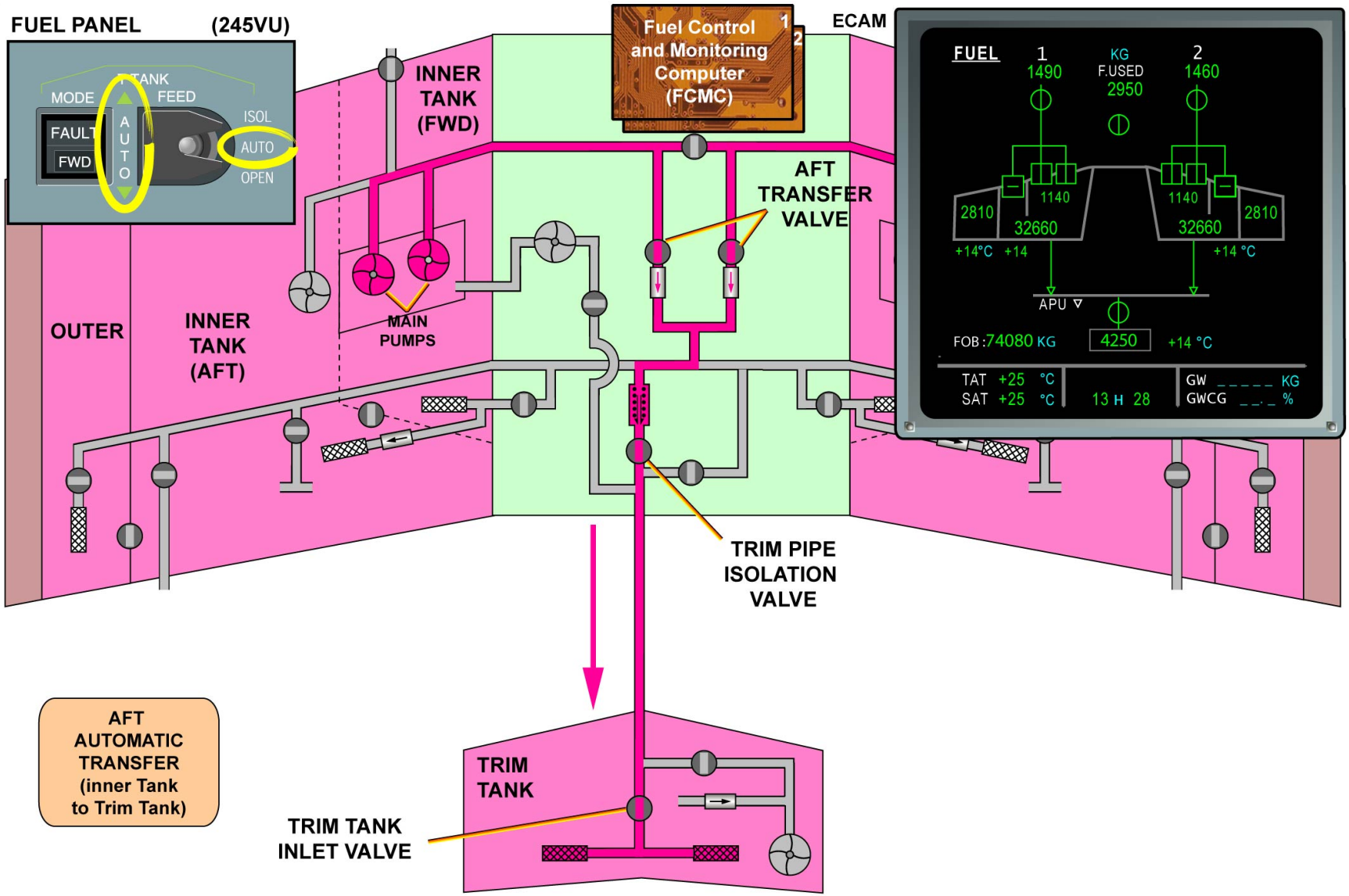

AFT TRANSFER AUTOMATIC OPERATION - INNER TANKS TO TRIM TANK TRANSFER

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TRIM TRANSFER D/O (A330-300)

AFT TRANSFER AUTOMATIC OPERATION (continued)

INNER TANKS TO TRIM TANK TRANSFER LOGIC

When the difference between the inner tanks 1 & 2 is more than 500 kg, the AFT transfer will stop on the lightest side, and the related AFT transfer valve will automatically close until fuel balance is restored.

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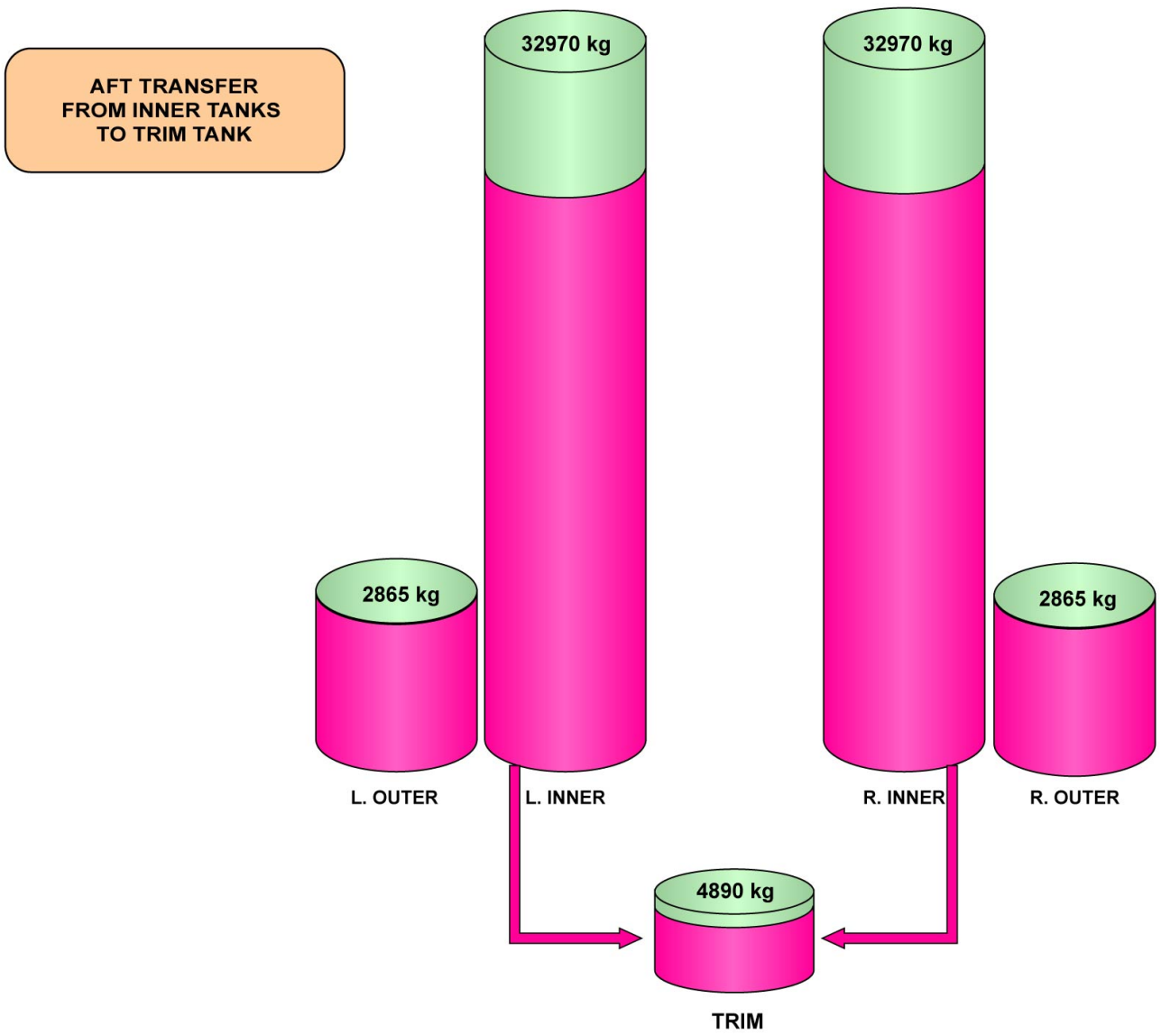

AFT TRANSFER AUTOMATIC OPERATION - INNER TANKS TO TRIM TANK TRANSFER LOGIC

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TRIM TRANSFER D/O (A330-300)

FWD TRANSFER AUTOMATIC OPERATION

The master FCMC sends a FWD transfer signal if one of these conditions occurs:
- the calculated CG is greater than the target CG (the FWD transfer continues until the calculated CG is less than the target CG minus 0.5% MAC),
- the fuel contents of one of the two inner tanks decrease to 4000 kg,
- the FCMCs receive a 35 minutes to destination signal,
- the A/C descends below FL 245.

The FWD transfer stops if one of these conditions occurs:
- one of the inner tanks fuel contents increases to 4000 kg,
- when the L/G lever is selected down,
- when the trim tank is empty.

Trim tank empty determination is made following this process:
- when the low level sensor in the trim tank becomes dry, the FCMC stops the trim tank pump.

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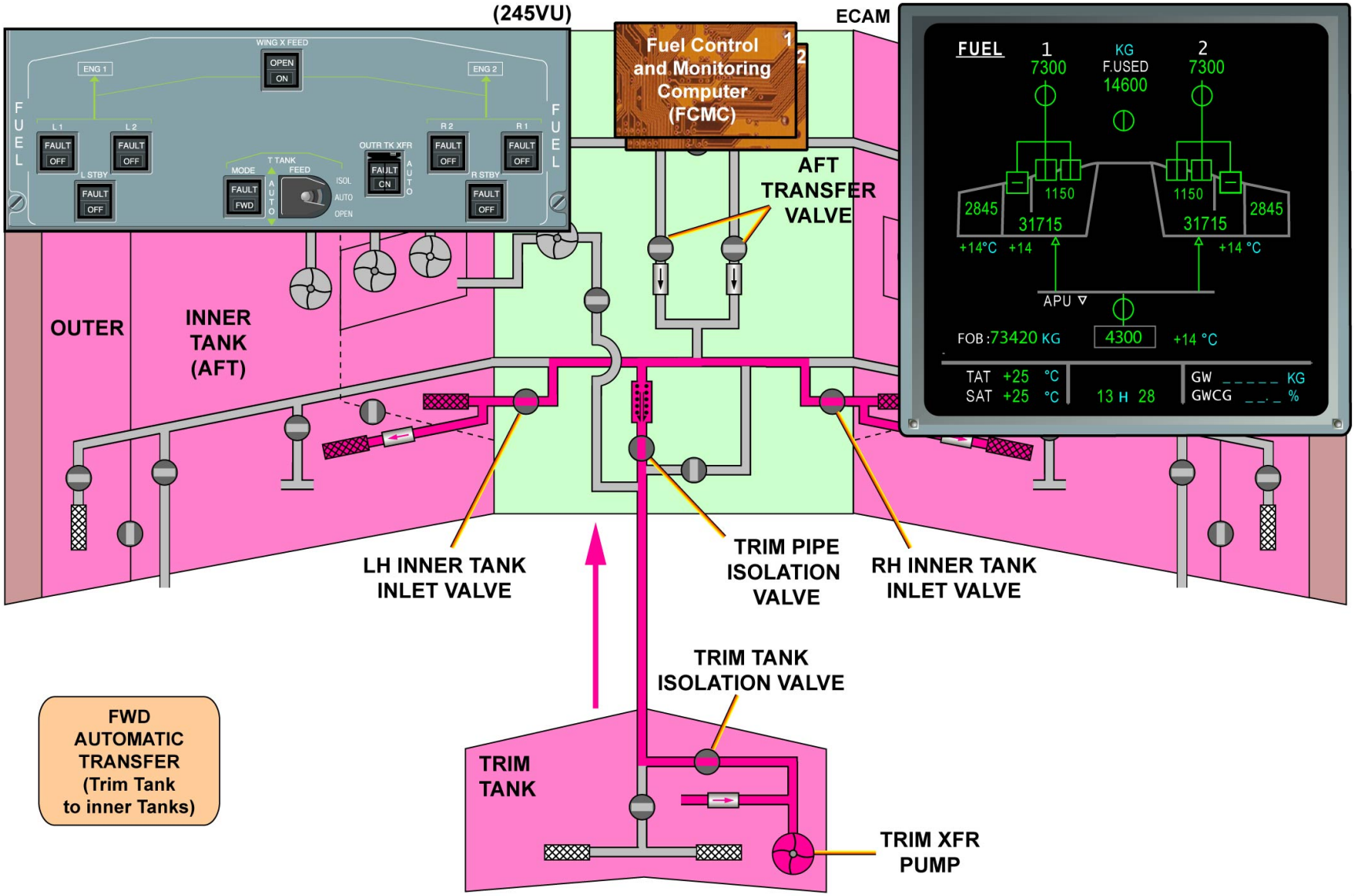

FWD TRANSFER AUTOMATIC OPERATION

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TRIM TRANSFER D/O (A330-300)

FWD TRANSFER AUTOMATIC OPERATION (continued)

TRIM TANK TO INNER TANKS TRANSFER

The FWD transfer is from the trim tank to the inner tanks.
It uses the fuel pressure of the trim transfer pump, the trim tank isolation valve, the trim pipe isolation valve, the inner tank transfer valve.
When the T TK MODE P/BSW is set to AUTO, the related trim transfer pump is controlled to operate by the FCMCs for water scavenging purposes, provided the trim tank is not empty. Usually, when the FCMCs start a FWD transfer, the computers have control of the trim tank isolation valve, the trim pipe isolation valve and the inner tanks inlet valves.
The transfer indication and pumps status are shown on the FUEL ECAM page.
The trim transfer pump stops when one of these conditions occurs:
- the aircraft is in flight and the landing gear is extended,
- there is less than 200 kg of fuel in trim tank and the trim tank lo-level sensor id dry for more than 60 seconds,
- the trim transfer pump pressure-switch has low pressure for more than 10 minutes.

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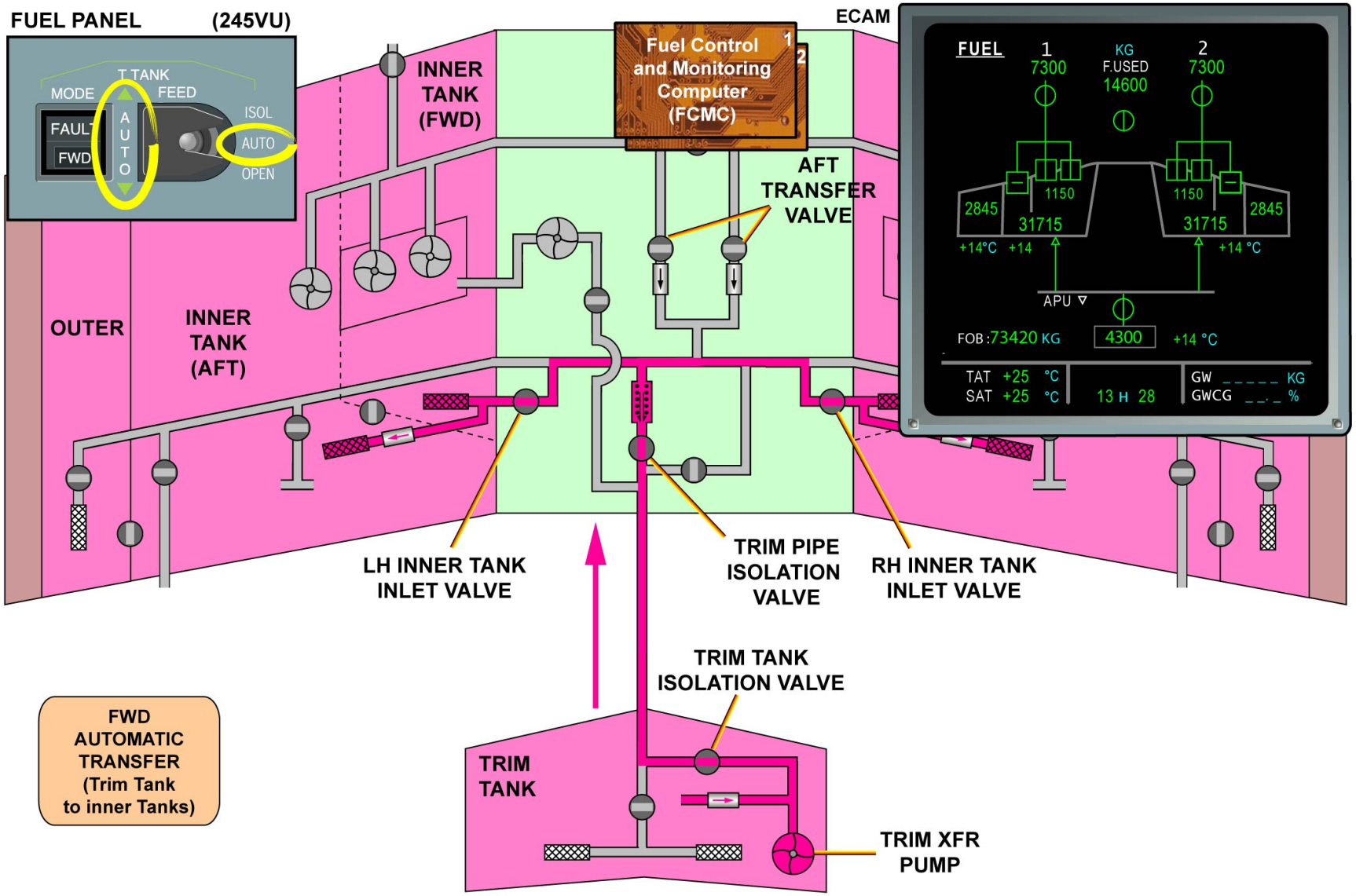

FWD TRANSFER AUTOMATIC OPERATION - TRIM TANK TO INNER TANKS TRANSFER

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TRIM TRANSFER D/O (A330-300)

FWD TRANSFER AUTOMATIC OPERATION (continued)

TRIM TANK TO INNER TANKS FWD TRANSFER LOGIC

When the inner tanks are not empty, the FWD transfer is done towards the inner tanks.

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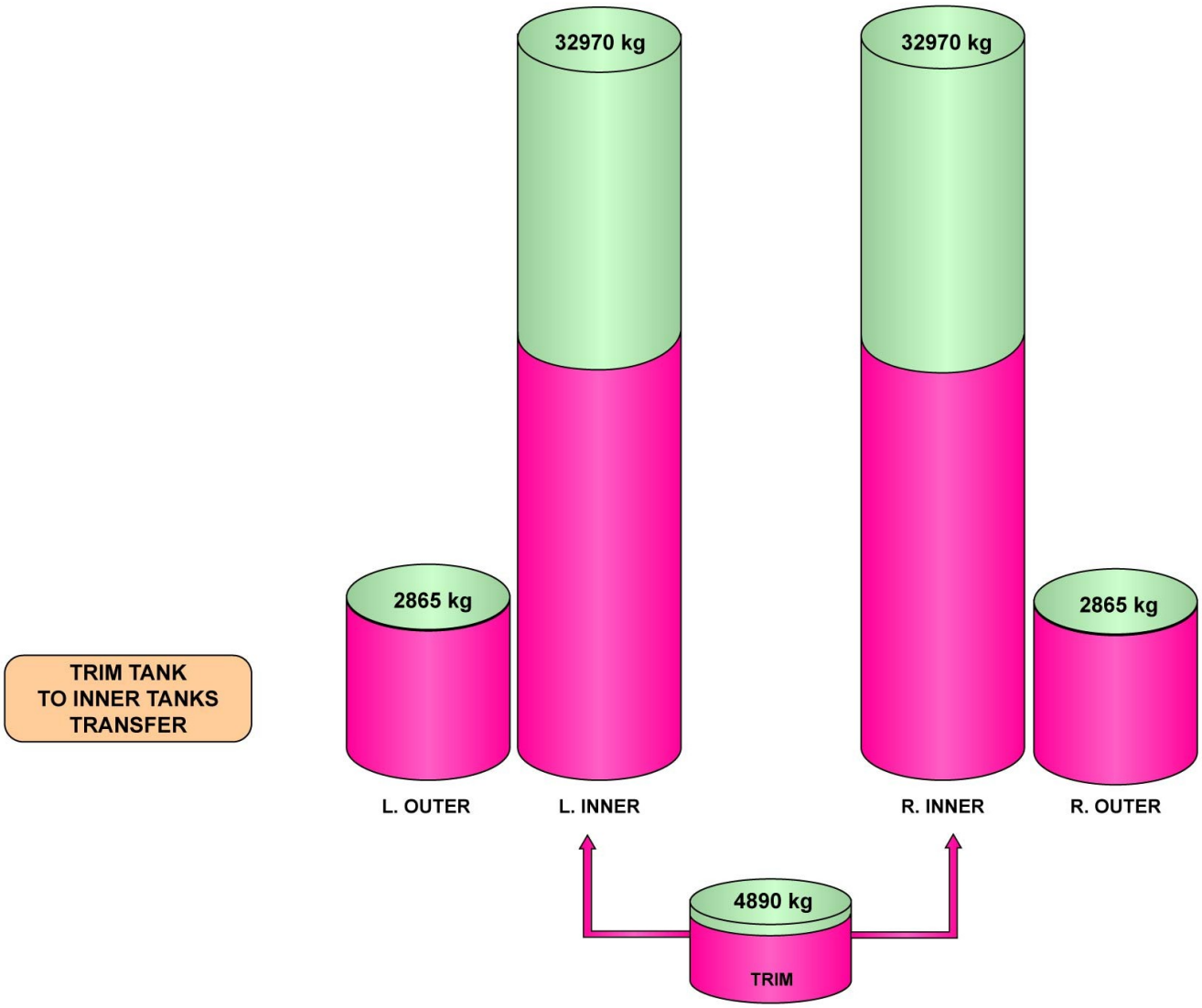

FWD TRANSFER AUTOMATIC OPERATION - TRIM TANK TO INNER TANKS FWD TRANSFER LOGIC

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TRIM TRANSFER D/O (A330-300)

MANUAL OPERATION

MODE "FWD" P/B SELECTION

When a failure is detected during the automatic CG control the FCMC triggers the FAULT light illumination on the MODE T TK P/BSW. When the MODE T TK P/BSW is set to FWD, the FWD light comes on white, the automatic FCMC CG control stops and a manual FWD transfer into the inner tanks starts. The FWD transfer has to be monitored to make sure that the inner tanks are not overfilled, since the inner tanks high level protection is not active.
The following components are controlled by wiring:
- the trim transfer pumps to run,
- the trim pipe isolation valve to close,
- the auxiliary FWD transfer and trim tank isolation valves to open.

When the trim tank becomes empty, the trim pump has to be switched off from the related P/BSWs since automatic shut-off is not active.

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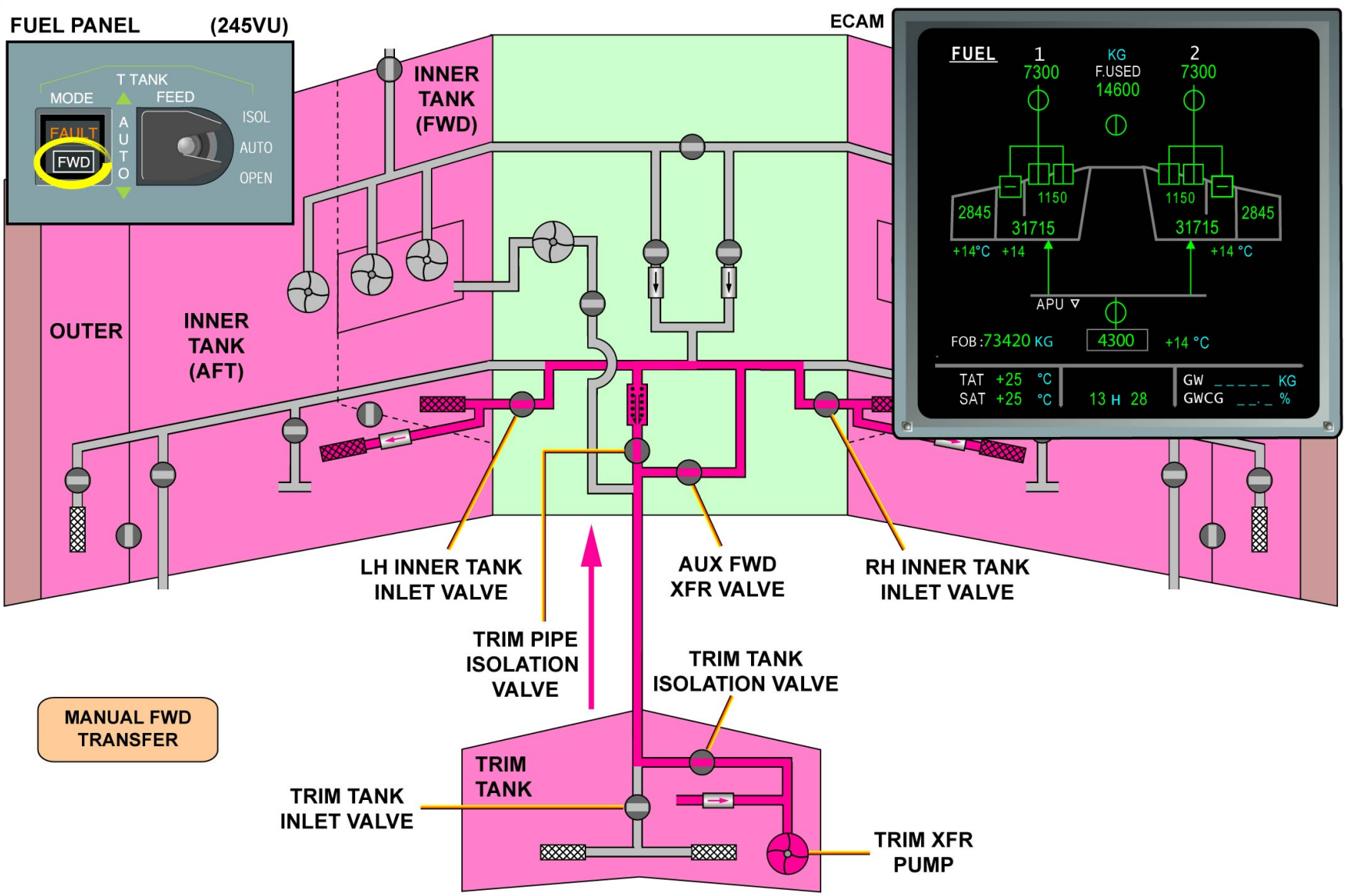

MANUAL OPERATION - MODE "FWD" P/B SELECTION

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TRIM TRANSFER D/O (A330-300)

MANUAL OPERATION (continued)

TRIM TANK FEED SWITCH SELECTIONS

The T TANK FEED switch has three positions AUTO, ISOL and OPEN.
AUTO is the usual position of the switch, which gives the FCMCs full control of the trim transfer system, provided that the "FWD" mode switch is in the OFF position (the T TK MODE P/BSW is in AUTO position).
In an abnormal situation, following an ECAM warning, trim transfer system isolation can be requested by selecting the T TK FEED switch to ISOL. In this position, the switch overrides the FCMC trim transfer control and the manual FWD transfer P/BSW.
By the wiring, the following valves are controlled to close:
- the trim tank inlet,
- the trim tank isolation,
- the auxiliary FWD transfer,
- the trim pipe isolation,

causing the trim pipe to be isolated at both ends.

NOTE: Note: If T TK FEED switch is set to ISOL (trim tank isolated), it is still possible to use the APU.

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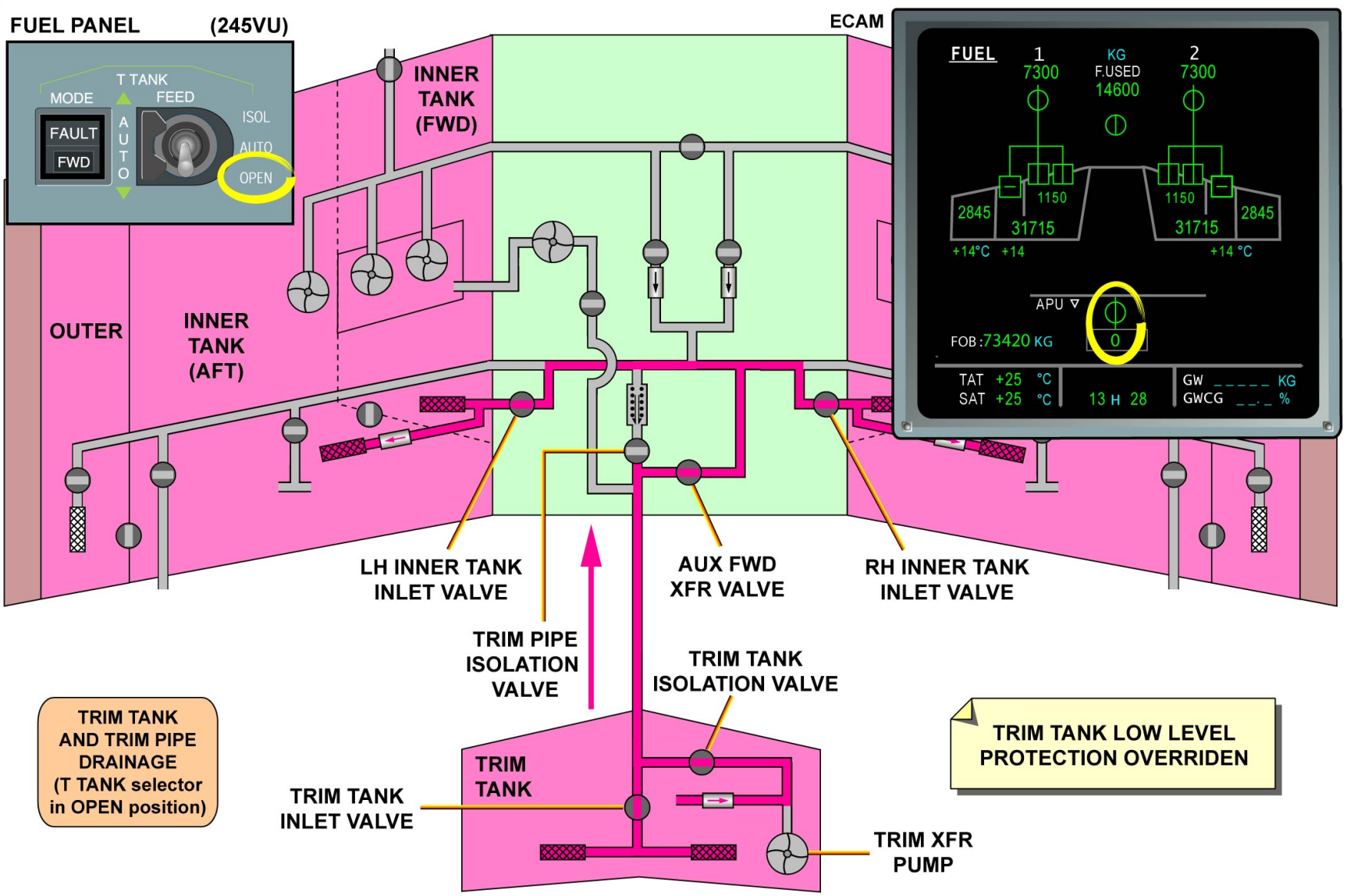

MANUAL OPERATION - TRIM TANK FEED SWITCH SELECTIONS

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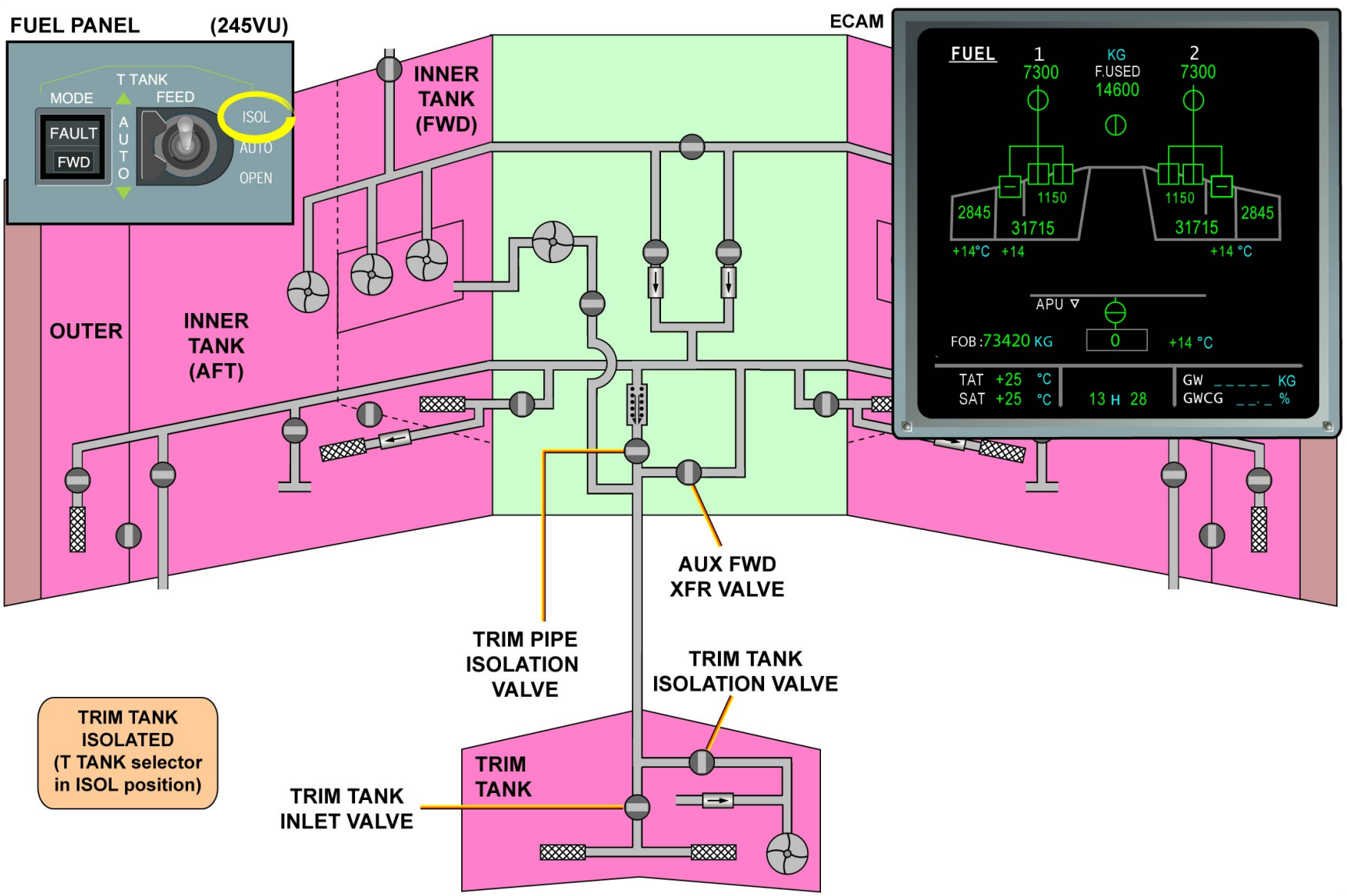

MANUAL OPERATION - TRIM TANK FEED SWITCH SELECTIONS

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AUTOMATIC REFUEL (2)

AUTOMATIC REFUEL OPERATION

Before starting the refuel/defuel procedure, some safety precautions have to be taken, such as safety barriers and "no smoking" warning notices. Especially, if a fuel tanker is used. Make sure that the fire-fighting equipment is available. The landing gear chocks should not touch their tires. But the parking brake must be on. The weight of the fuel can suddenly compress the landing gear and lower the aircraft : make sure there is no equipment below the aircraft which can cause damage. All electrical equipment you use must not cause sparks and a water contamination check on a fuel sample must be performed.
For refuelling at the terminal, a ground pumping unit is used. The ground pumping unit is positioned under the wing, below the refuel/defuel coupling access panel. The ground cable is connected to the aircraft on the landing gear. The platform is lifted up to the refuel/defuel station. One, two, three or four refuel hoses can be connected to perform an automatic pressure refuel. We are going to use two on the LH wing. The panel is opened. The two refuel/defuel coupling caps removed. The two fuel supply hoses are connected. The caution placard indicates : do not let the refuel pressure get to more than 50 psi or 3.5 bars. As we are at the terminal, the refuelling pump unit is connected to the ground installation. Under the fuselage fairing, open the door of the refuel/defuel control panel 990 VU. If external electrical power or APU electrical power is not available, it is also possible to use the aircraft batteries. First of all, a test is to be performed. Lift the guard, then push and hold the high level test switch.
Check that:
- the high level and overflow lights change state,
- cockpit and end lights come on, on the F.Q.I. indicator,
- the fuel quantity, preselected and actual displays show all eights.

When the test switch is released, after a few seconds, all lights and quantity displays return to their initial condition. With the load switch, increase the preselected quantity up to the necessary fuel load. Adjust it. 74 tonnes are selected. Make certain that all refuel/defuel valves switches are in the norm position and guarded. Set the mode selector switch to the refuel position. The pump on the ground pumping unit can be started. Monitor that the fuel quantity indication increases. All tanks that are to receive fuel are filled simultaneously. The actual indication increases together with the tank quantities.
Note as the refuelling is performed only from the left hand side couplings, the left hand fuel tanks will be filled before the right hand ones.
When a tank is full, its high level light comes on. Here, the left outer tank. Its inlet valve closes. The right outer tank is also full. As the preselected quantity is 74 tonnes, no fuel is sent to the center tank, but there is some fuel in the trim tank. The inner tanks continue to fill.
The Fuel Control and Monitoring Computer (F.C.M.C.) controls the distribution of the fuel in the different tanks. The left inner tank is full. (The left inner tank blue high level light is on. Now, both wing tanks are full.
The refuelling automatically stops as the end light comes on, steady ; "actual" and "preselected" displays agree and are stable with a 200 kg tolerance. Stop the pump on the ground pumping unit. On the refuel/defuel control panel, set the mode selector switch to off. All switches being in the normal and guarded position, the panel door is closed.
Disconnect the fuel supply hoses from the aircraft refuel/defuel couplings, and re-install the coupling caps. Close the access panel. Remove the platform. Disconnect the ground/bonding cables. If not needed, de-energize the aircraft electrical circuits. Put the chocks back in their original position. The automatic refuel operation is finished, verify that the area is clean and clear of any equipment. When servicing and passenger loading is completed, the A340 is ready for departure.

AUTOMATIC REFUEL OPERATION

REFUEL/DEFUEL D/O (A330-200)

GENERAL

There are three different procedures to refuel the A/C - the pressure refuel in automatic or manual mode, and the overwing refuel. The A/C is fitted with two refuel couplings (optional on left wing) and there are refuel hose adaptors on each coupling. The A/C can be refueled through one or more of the refuel hose adaptors. When four refuel hoses are in use, the minimum time to pressure refuel the A/C, from empty tanks to maximum fuel capacity, is approximately 35 minutes. The refuel pressure at the refuel hoses must not exceed 50 psi. There are two procedures to defuel the A/C - the pressure defuel using the A/C fuel pumps and the suction defuel using an external suction device (11 psi max.). The A/C can be defueled through one or more of the refuel hose adaptors. But when only one adaptor on a refuel/defuel coupling is used, it must be the one identified by the "USE THIS ADAPTOR TO DEFUEL" marking. These two procedures can be used at the same time to increase the defuel rate.
Refuel/defuel operations are started from the refuel/defuel control panel or optionally from the cockpit REFUEL panel, for automatic refuel only.
The refuel/defuel control panel is located in the RH side of the belly fairing. A similar control panel can be installed as an option, next to the refuel/defuel couplings, at the bottom of the wing leading edge (on one wing or both wings).
Ground transfers from tank to tank - except to the trim tank - can be started from the refuel/defuel control panel.
The Fuel Control and Monitoring Computer (FCMC) gives overflow protection by closing the refuel/defuel isolation valves and stopping any type of refuel/defuel or ground transfer operation if any of the overflow sensors (fitted in surge tanks) become wet. The FCMC distributes the set quantity of fuel in the different tanks so that no hazardous overbalance condition occurs in all modes of fuel operation.

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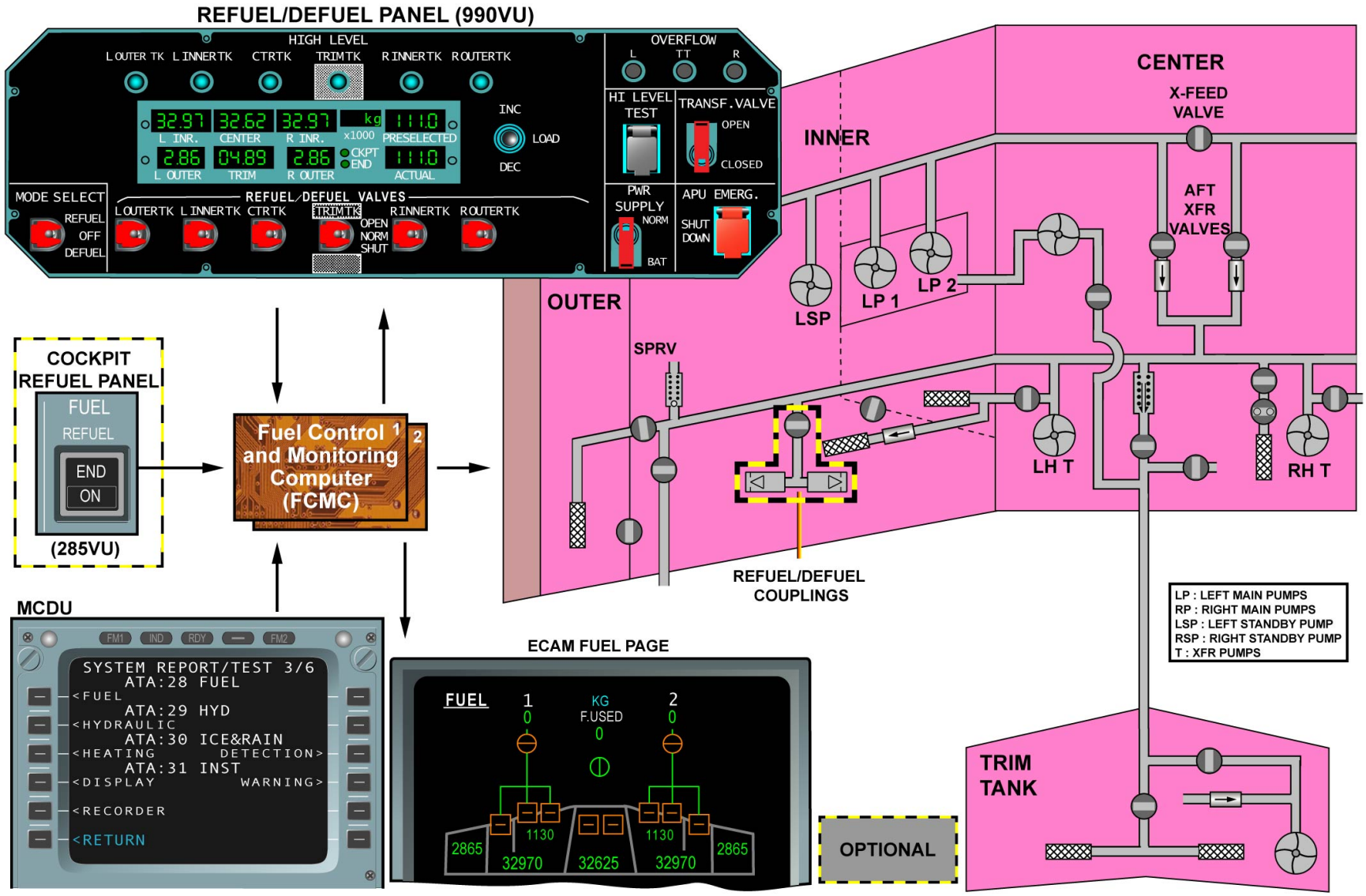
REFUEL/DEFUEL PANEL (990VU)
HIGH LEVEL
L OUTER TK
L INNER TK
CTR TK
TRIM TK
R INNER TK
R OUTER TK
OVERFLOW
L
TT
R
HI LEVEL TEST
TRANSF. VALVE
OPEN
CLOSED
INC
LOAD
DEC
32.97
32.62
32.97
kg
111.0
L INR.
CENTER
R INR.
x1000
PRESELECTED
2.86
04.89
2.86
CKPT
END
111.0
L OUTER
TRIM
R OUTER
ACTUAL
MODE SELECT
REFUEL
OFF
DEFUEL
REFUEL/DEFUEL VALVES
L OUTER TK
L INNER TK
CTR TK
TRIM TK
R INNER TK
R OUTER TK
OPEN
NORM
SHUT
PWR SUPPLY
NORM
BAT
APU EMERG. SHUT DOWN
CENTER
X-FEED VALVE
INNER
AFT XFR VALVES
OUTER
LSP
LP 1
LP 2
SPRV
LH T
RH T
COCKPIT REFUEL PANEL
FUEL
REFUEL
END
ON
(285VU)
Fuel Control and Monitoring Computer (FCMC) 1 2
REFUEL/DEFUEL COUPLINGS
MCDU
FM1
IND
RDY
FM2
SYSTEM REPORT/TEST 3/6
ATA:28 FUEL
<FUEL
ATA:29 HYD
<HYDRAULIC
ATA:30 ICE&RAIN
<HEATING DETECTION>
ATA:31 INST
<DISPLAY WARNING>
<RECORDER
<RETURN
ECAM FUEL PAGE
FUEL
1
2
KG
F.USED
0
0
0
2865
1130
32970
32625
1130
32970
2865
LP : LEFT MAIN PUMPS
RP : RIGHT MAIN PUMPS
LSP : LEFT STANDBY PUMP
RSP : RIGHT STANDBY PUMP
T : XFR PUMPS
OPTIONAL
TRIM TANK

GENERAL

REFUEL/DEFUEL D/O (A330-200)

DESCRIPTION

Here is a description of the refuel/defuel system in different conditions.

REFUEL/DEFUEL CONTROL PANEL

The primary components of the refuel/defuel control panel are:
- the PoWeR SUPPLY (NORM/BAT) switch, for refuel/defuel on batteries HOT BUS power supply if there is no normal supply,
- the HI LEVEL TEST switch,
- the APU EMERGency SHUTDOWN switch,
- the preselect (LOAD select) switch, used for automatic refuel only,
- the MODE SELECT switch, guarded in OFF position
- the REFUEL/DEFUEL VALVES switches, guarded in NORM position
- the refuel indicator panel.

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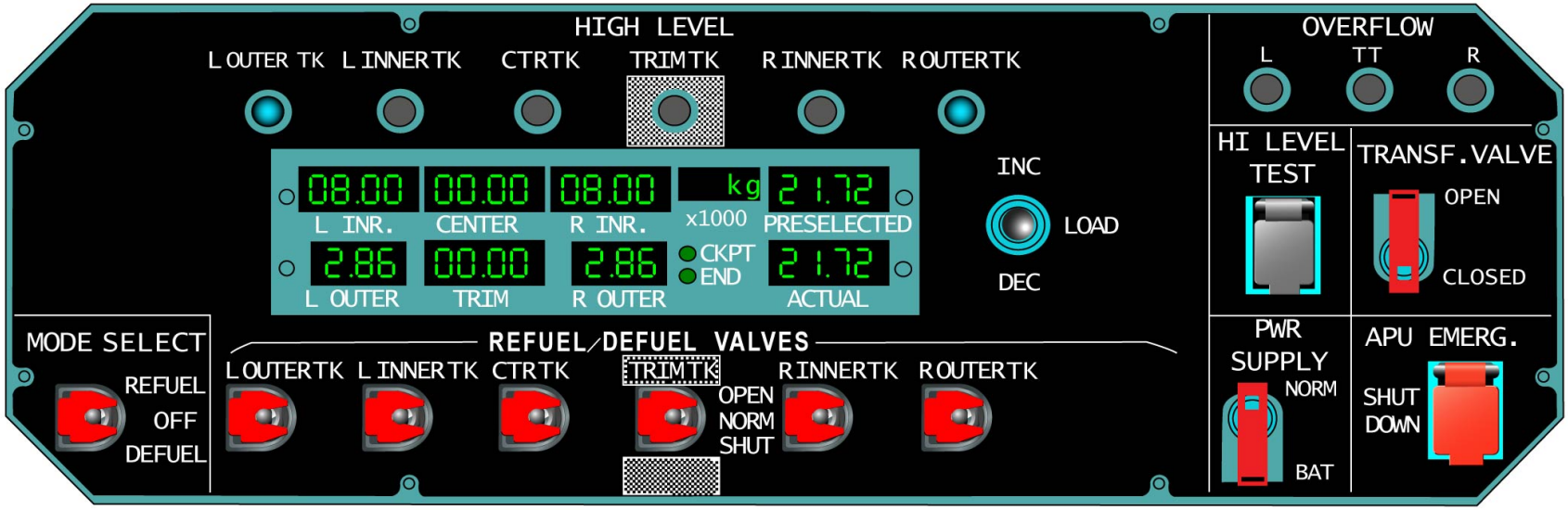
REFUEL/DEFUEL PANEL (990VU)



DESCRIPTION - REFUEL/DEFUEL CONTROL PANEL

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REFUEL/DEFUEL D/O (A330-200)

DESCRIPTION (continued)

REFUEL/DEFUEL COUPLINGs

One refuel/defuel coupling is installed on the RH wing. One additional coupling is installed as an option on the LH wing. Each coupling is attached to the front face of the wing front spar. Each refuel/defuel coupling has a Y-shaped hollow body, with a circular housing in the center to receive the refuel isolation valve. Each refuel/defuel coupling is equipped with two refuel adaptors. Each refuel adaptor is protected by a removable cap.

REFUEL ISOLATION VALVES

The refuel isolation valve is electrically controlled via a solenoid and hydraulically operated. When the valve is energized and a fuel pressure is supplied, the isolation valve opens. The isolation valve has a manual override button that can be used to open the valve if there is electrical or solenoid failure. The refuel isolation valve is installed in the center of each refuel/defuel coupling.

OUTER, INNER, CENTER TANKS TRIM INLET VALVES AND ACTUATORS

All inlet valves are of the ball valve type and are operated by a single DC motor actuator fitted with a visual open/close indicator. They are connected to the refuel/defuel gallery and allow fuel distribution to the various tanks through dedicated supply lines.
Two outer tank inlet valves, one for each outer tank, are installed in the inner tanks and attached to the front face of the wing rear spar. Their electrical actuators are fitted on the rear face of this spar.
The inner tank inlet valves are installed in the fuel supply line to both inner tanks. These valves are fitted in the center tank and attached to the forward face of the center fuselage rear spar. Their actuators are attached to the rear face of this spar.
A center tank inlet valve is installed in the center tank and is attached to the front face of the rear spar. Its actuator is fitted on the rear face of the rear spar.
A trim tank inlet valve is installed in the trim tank and its actuator is attached under the bottom skin.

CENTER TANK INLET RESTRICTOR VALVE

The center tank inlet restrictor valve is located immediately downstream of the center tank inlet valve. Its function is to prevent overpressure of the center tank structure. During defueling, the valve is in the restricted position. The valve is installed in the center tank and attached to the front face of the rear spar. It is operated with a single electrical motor actuator attached to the rear face of the rear spar and equipped with a visual position indicator.

EMERGENCY ISOLATION VALVES

The emergency isolation valves are of the ball valve type, each one operated by two DC motor actuators. One valve is installed in each inner tank and its actuator is attached to the wing rear spar. During normal operation, both emergency isolation valves are open to do fuel quantity balancing between the forward and aft sections of each inner tank.

CHECK VALVES

Two check valves prevent fuel flow from the refuel gallery to the engine feed gallery in case any aft transfer valve is stuck in the open position.

REFUEL DIFFUSERS

The fuel is delivered into the fuel tanks through diffusers.

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SURGE-PRESSURE RELIEF VALVE

During refueling, two surge-pressure relief valves prevent a pressure surge into the refuel gallery. If the fuel pressure is more than 65 psi the valve opens to decrease the pressure in the gallery.

DEPRESSURIZING VALVE

A depressurizing valve is fitted on the refuel gallery in the right inner tank only. After the refuel operation has been completed, the depressurizing valve releases the remaining pressure in the refuel gallery into the right inner tank. The valve operates between 2 and 3 psi.

RESTRICTOR VALVE

A one-way restrictor valve is installed on the refuel gallery upstream of the trim pipe isolation valve. It decreases the fuel flow directed to the trim tank and lets the fuel flow freely in the opposite direction.

REFUEL GALLERY LOW-PRESSURE SWITCH

A LP switch, attached to the center fuselage rear spar, detects any LP condition (below 6 psi) in the refuel gallery. If a LP condition is detected during refueling of the trim tank with the APU operating (fed by the AFT APU pump), the trim transfer line is isolated. Refueling of the trim tank is temporarily stopped and the APU is fed by the FWD APU pump, until the LP condition disappears.

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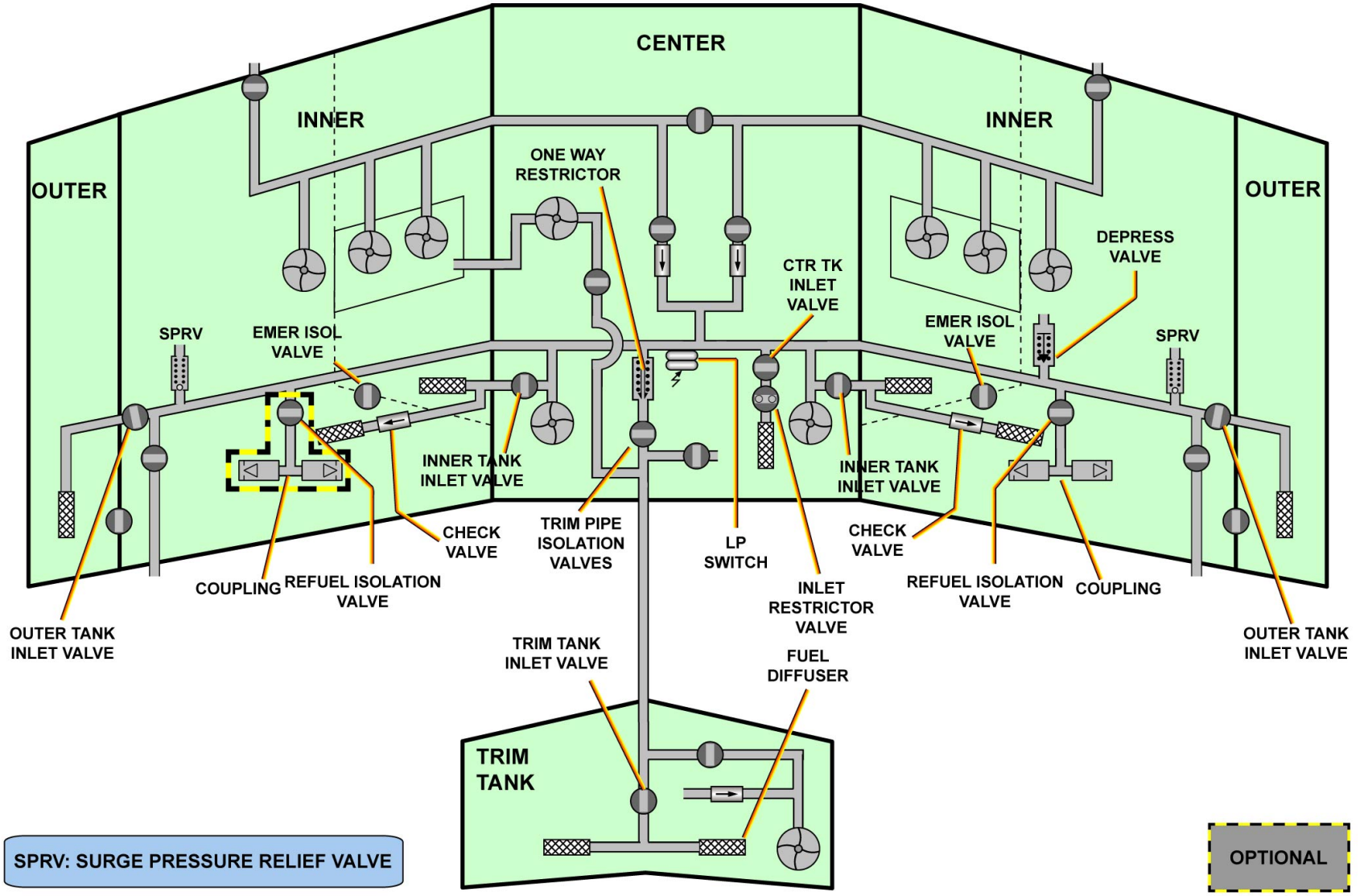

DESCRIPTION - REFUEL/DEFUEL COUPLINGS ... REFUEL GALLERY LOW-PRESSURE SWITCH

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REFUEL/DEFUEL D/O (A330-200)

OPERATION

When the quick-release door of the refuel/defuel control panel is open, a door-operated microswitch sends a signal to the FCMCs to supply the refuel/defuel electrical circuits. Once the refuel/defuel panel is powered, any refuel, defuel or ground transfer can be started.
The Air Data Inertial Reference Systems (ADIRS) are set to NAV so that the FCMCs receive the A/C attitude information required for maximum accuracy as regards tank fuel quantity calculation.

NOTE: Note: If external electrical power or APU electrical power is not available, it is possible to use A/C batteries to do a refuel. But on batteries, the ADIRS do not send A/C attitude information to the FCMCs. Therefore, after a refuel on batteries, there could be a difference of up to 750 kg between the set fuel quantity and the actual fuel quantity.

HI-LEVEL TEST

When the guarded HI LEVEL TEST P/BSW is pushed in and held, it sends a signal to the FCMCs, which do a continuity test of the high-level and overflow sensors and their circuits. If these are serviceable, the FCMCs change the HIGH LEVEL blue lights and the OVERFLOW amber lights to their opposite condition. In addition, the CKPT and END lights come on and the fuel quantity, PRESELECTED for Preselected Fuel Quantity (PFQ) and ACTUAL for Fuel On Board (FOB) all display 8s. At the same time, the FCMC tests the operation of the inlet valves and checks the continuity of the refuel isolation valve circuit.
When the HI LEVEL TEST P/BSW is released out, the following has to be checked:
- the HIGH LEVEL and OVERFLOW lights go back to their initial condition,
- the fuel quantity, PRESELECTED (PFQ) and ACTUAL (FOB) displays go back to their initial values,
- the CKPT and END lights go off.

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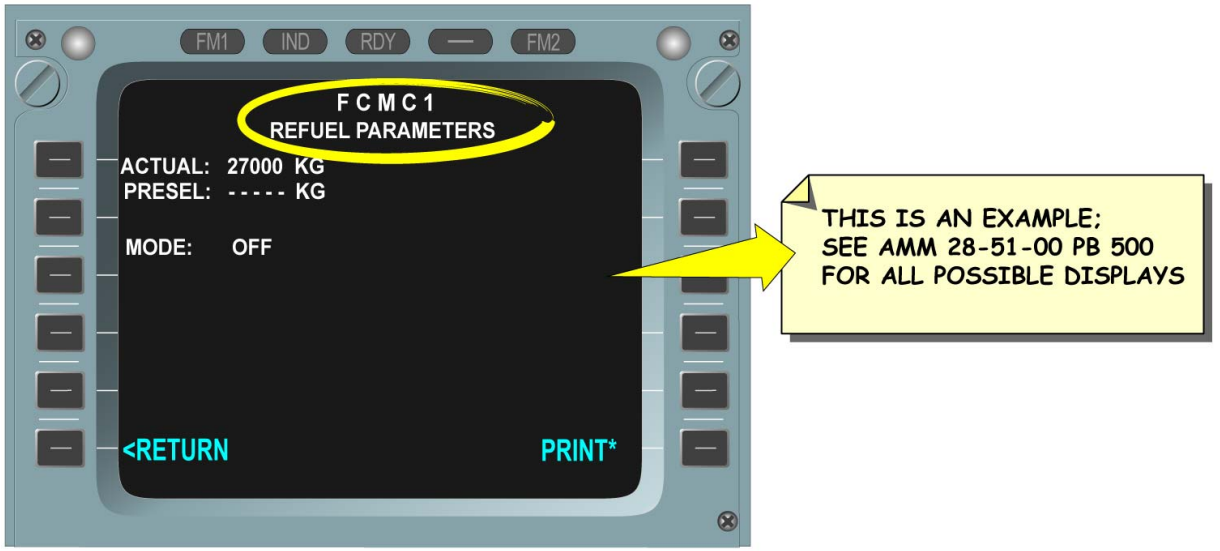
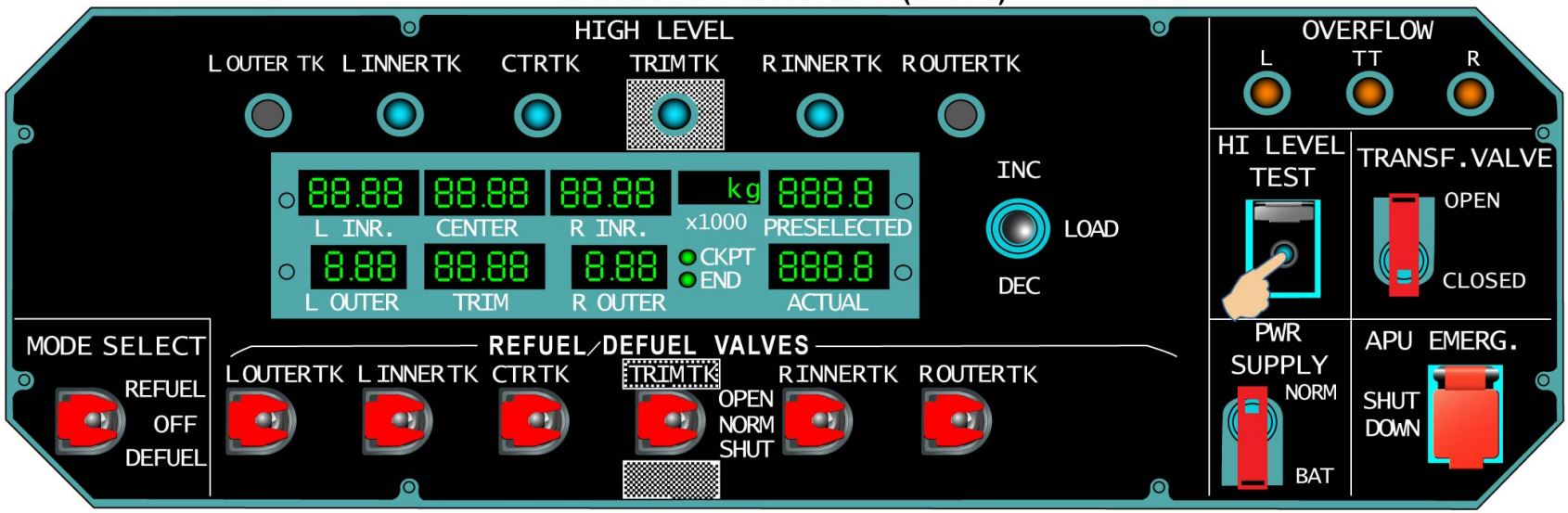
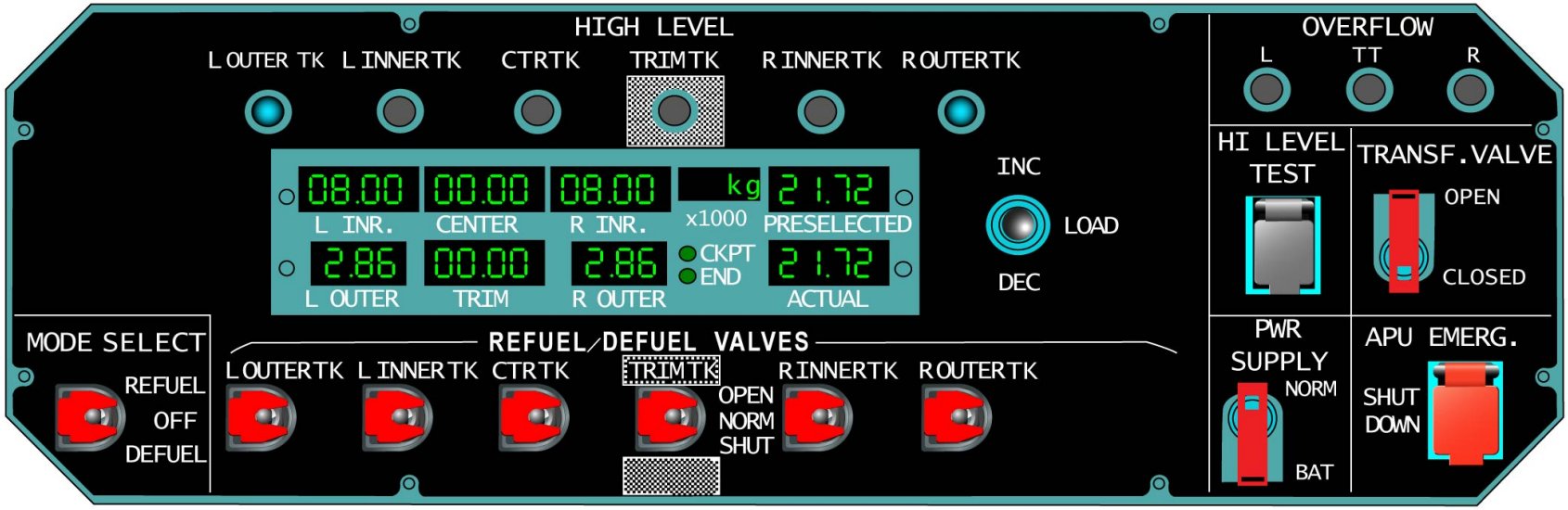


REFUEL/DEFUEL PANEL (990VU)



OPERATION - HI-LEVEL TEST

REFUEL/DEFUEL PANEL (990VU)



OPERATION - HI-LEVEL TEST

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REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

AUTOMATIC PRESSURE REFUEL

During an automatic refuel and after the high level test, the PRESELECTED switch is used to preselect the fuel quantity on the PRESELECTED display. To start a refuel, this quantity must be set to a value, which is more than 200 kg greater than the ACTUAL indication.

The FCMCs receive this preselection and refer to the memorized post-refuel distribution chart to select the tanks to be refueled and to calculate their respective fuel quantity targets.

When the MODE SELECT switch is set to REFUEL, the FCMC supplies 28 VDC to the refuel/defuel isolation valve solenoids. When a refuel pressure is supplied, the isolation valves open hydraulically and let the fuel go into the refuel/defuel gallery. The FCMC then controls all the tank inlet valve relays involved in the refueling from the distribution chart. The tanks involved are refueled simultaneously.

As the individual tank fuel quantity increases, the FCMC closes the related inlet valve when the fuel tank quantity target is reached or the high-level sensors become wet.

At the end of the refuel, the END light comes on steadily to indicate a complete successful refueling. The MODE SELECT switch is set to OFF and the refuel isolation valve closes.

An automatic refuel may not start or be aborted by the FCMC if any of the following conditions occur:

- "BLOCK" fuel value entered in MCDU "INIT" page,
- OUTR TK XFR or T TANK MODE P/BSW not in AUTO mode,
- any REFUEL/DEFUEL VALVES switch not in NORM position,
- any inlet valve position disagrees with FCMC command,
- any surge tank overflow fuel sensor becomes wet,
- the center tank high level sensor becomes wet,
- any jettison valve is detected open (if installed),
- any high level sensor failure,
- any tank fuel quantity indication function inoperative.

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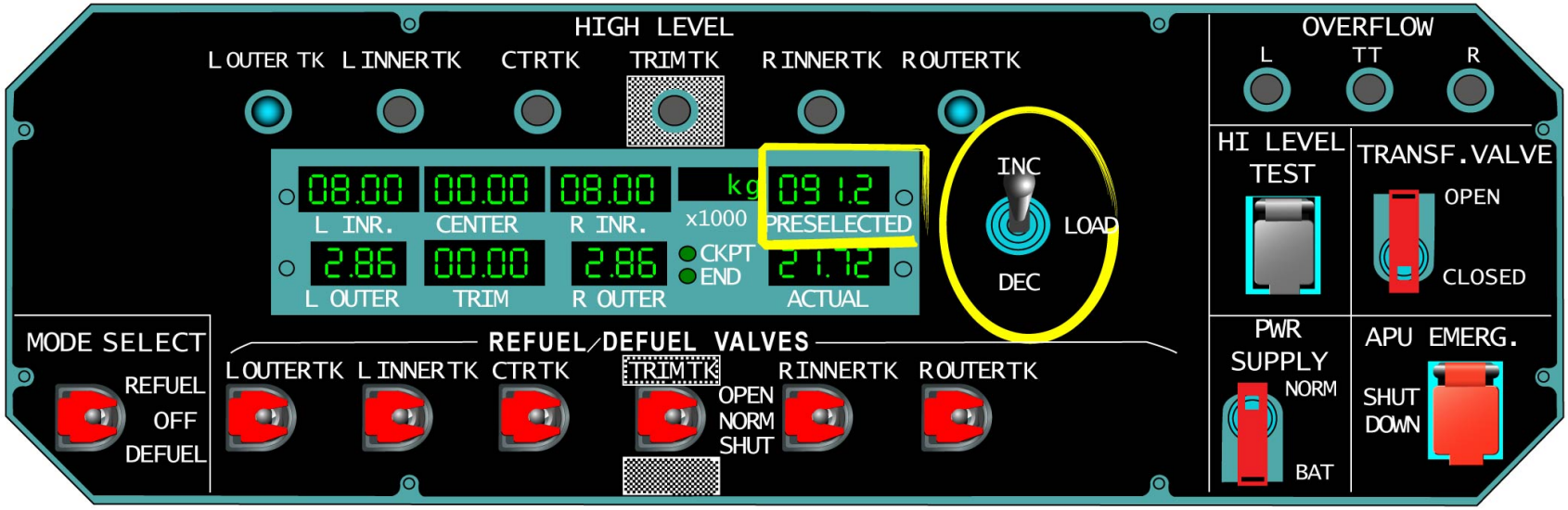
REFUEL/DEFUEL PANEL (990VU)



AUTO REFUEL

OPERATION - AUTOMATIC PRESSURE REFUEL

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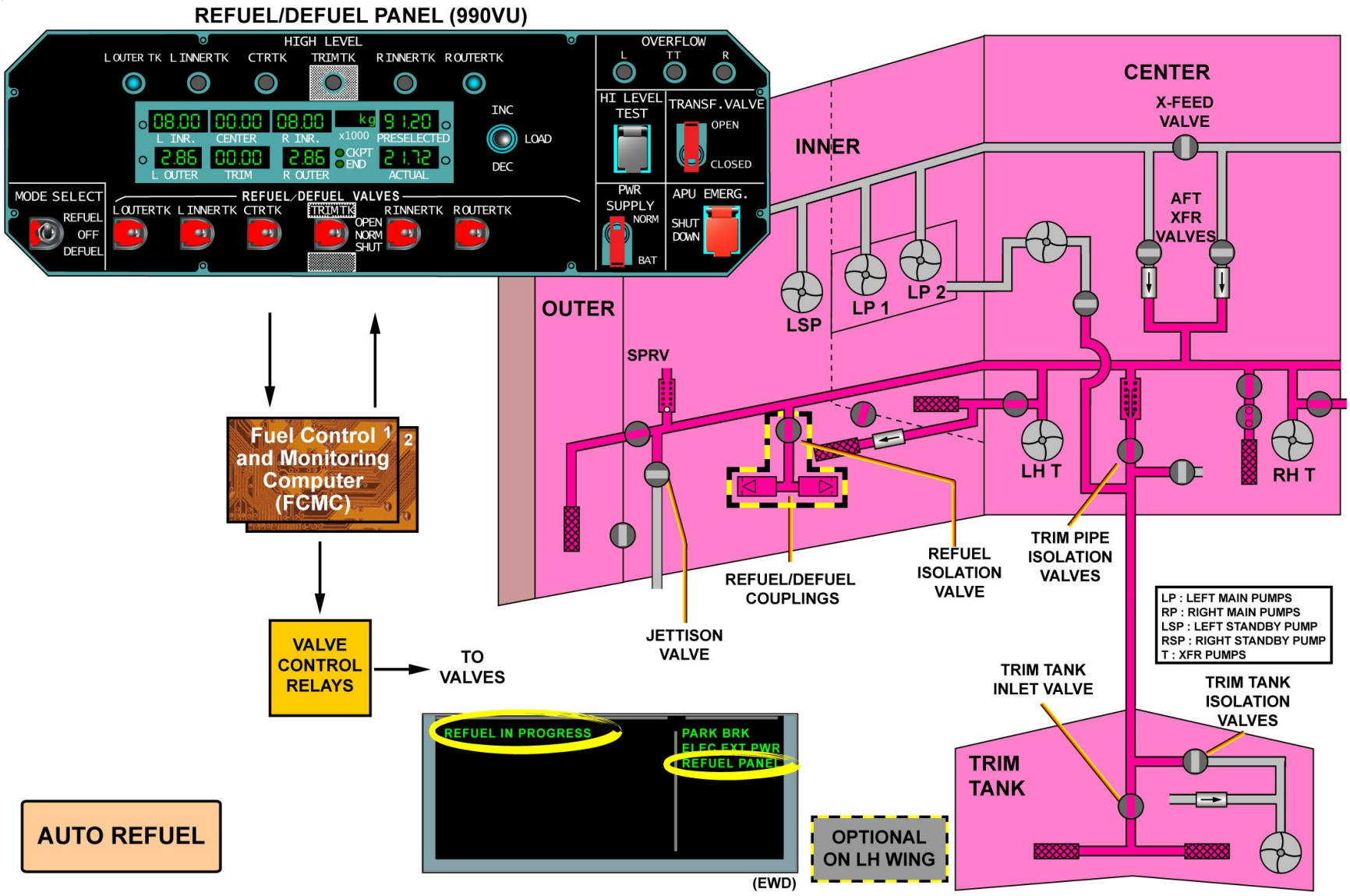
OPERATION - AUTOMATIC PRESSURE REFUEL



OPERATION - AUTOMATIC PRESSURE REFUEL

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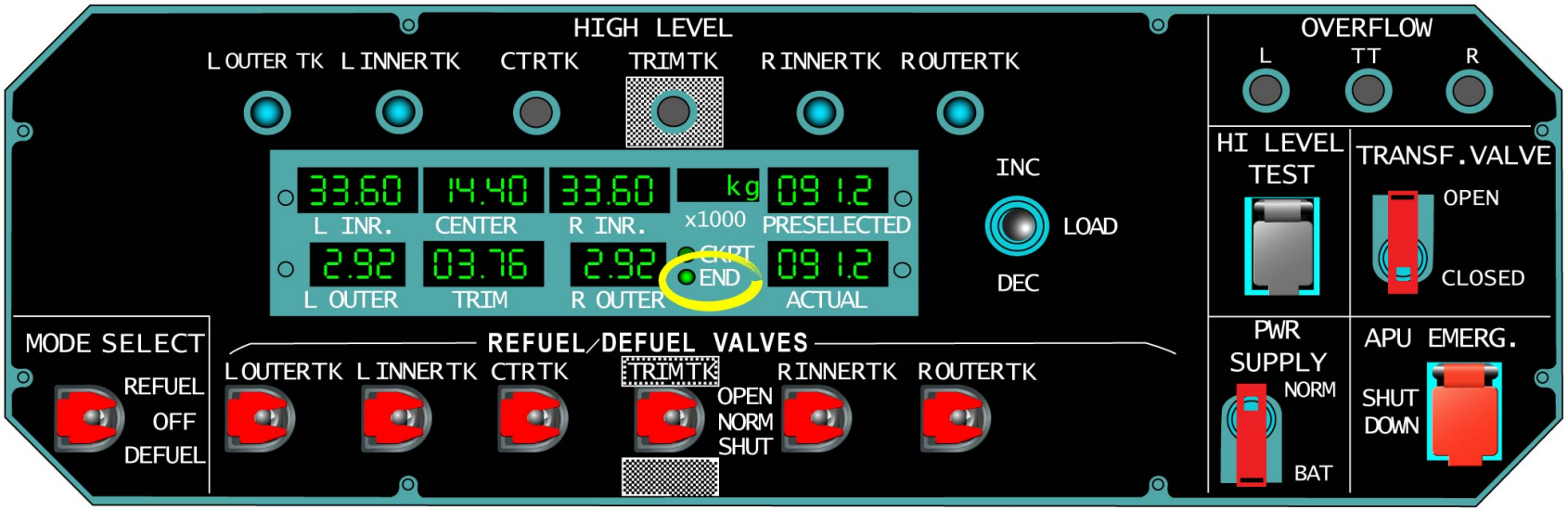
REFUEL/DEFUEL PANEL (990VU)



AUTO REFUEL

OPERATION - AUTOMATIC PRESSURE REFUEL

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REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

REFUEL ABORT

The refuel process is aborted in case of:
- MAN XFR selection, or
- Inlet valve failure or high level test failure, or
- Overflow detection with an amber light on the refuel/defuel panel.

In this case, the FCMCs abort the refuel, the MCDU displays the refuel aprameters and the END LIGHT on the refuel/defuel panel flashes.

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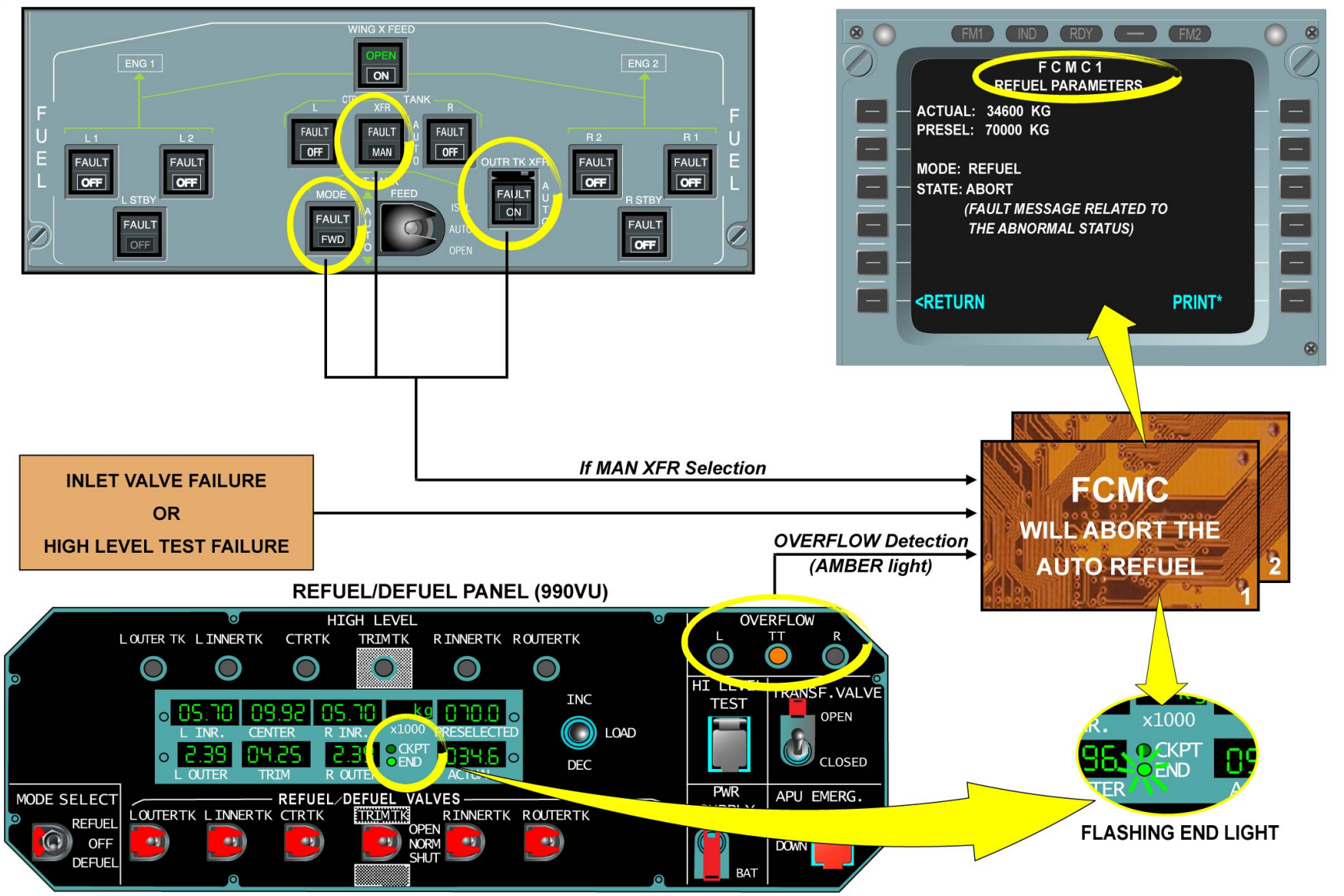

OPERATION - REFUEL ABORT

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REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

MANUAL PRESSURE REFUEL

A manual refuel procedure is only required when an automatic refuel aborts due to a system failure. On the refuel/defuel panel, the PRESELECTED quantity must be set to zero or 500 kg below the ACTUAL quantity. The REFUEL/DEFUEL VALVE switches of the tanks to be refueled are set to OPEN and the REFUEL/DEFUEL VALVE switches of the tanks not to be refueled are set to SHUT. The MODE SELECT switch is then set to the REFUEL position to send a signal to the FCMC, which connects a 28 VDC supply to the solenoid of the refuel isolation valves. If refuel pressure is available, the refuel isolation valves open. The tanks involved are refueled simultaneously.

NOTE: Note: The refueling distribution chart, shown in the automatic refuel subtopic, can be referred to (through the AMM) to ensure optimization of fuel distribution during manual refueling.

Each inlet valve can be closed manually, by moving the related REFUEL/DEFUEL VALVE switch to SHUT or NORM, but the FCMC automatically closes the inlet valve when the related hi-level sensors become wet. All the selected fuel tanks are normally refueled at the same time, except when the FCMC applies the overbalance protection.

To keep a safe longitudinal balance, the trim tank inlet valve does not open unless one of these conditions occurs:

- the fuel quantities of the two inner tanks are above 14,000 kg,
- one inner tank fuel quantity is above 14,000 kg and the other inner tank inlet valve is open,
- the center tank inlet valve is open,
- the two inner tank inlet valves are open.

At the end of the refuel, the MODE SELECT switch is set to OFF and the refuel isolation valves close.

A manual refuel may not start or be aborted by the FCMC if any of the following conditions occurs:

- OUTR TK XFR or T TANK MODE P/BSW not in AUTO mode,
- any surge tank overflow fuel sensor becomes wet,
- the center tank high level sensor becomes wet,
- any jettison valve is detected open,
- any high level sensor failure.

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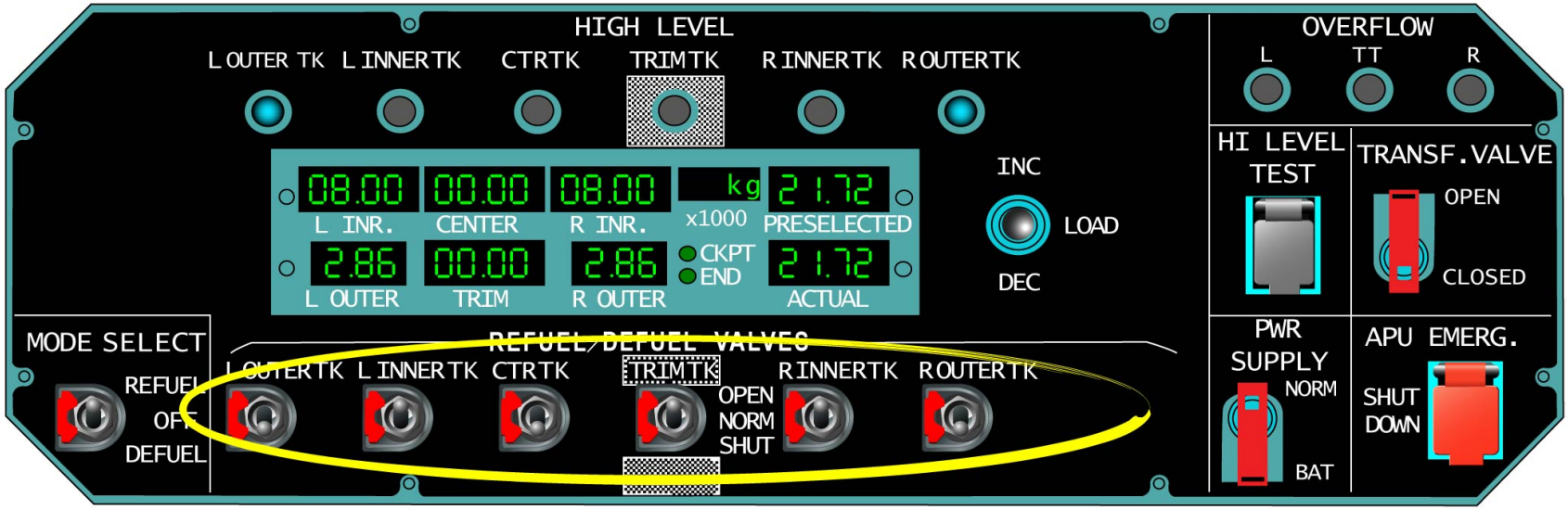
REFUEL/DEFUEL PANEL (990VU)



MANUAL REFUEL

OPERATION - MANUAL PRESSURE REFUEL

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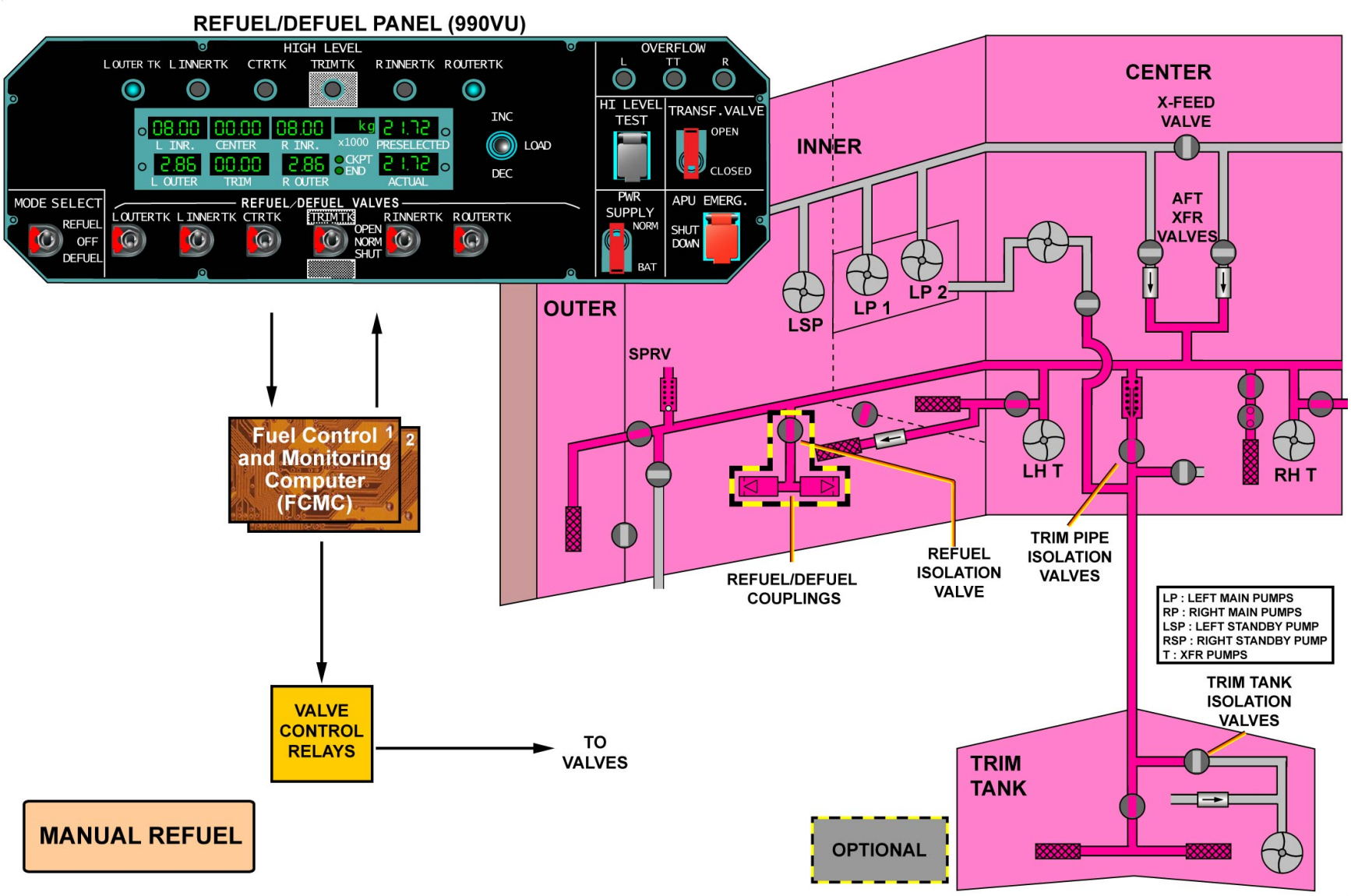

OPERATION - MANUAL PRESSURE REFUEL

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REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

COCKPIT AUTOMATIC REFUEL

Optionally, it is possible to do an automatic refuel from the cockpit. The required total fuel quantity must be entered via the MCDU as a BLOCK fuel on the INIT page 2. The quantity must be at least 200 kg more than the FOB quantity shown on the ECAM FUEL page.
On the cockpit REFUEL panel, when the REFUEL P/BSW is pressed in, the white ON light comes on and the master FCMC does an automatic high level test. If the test is OK, the FCMC starts the automatic refuel. If the high level test fails, the green END light flashes in the REFUEL P/BSW.
When the refuel is complete and correct, the green END light comes on steadily in the REFUEL P/BSW.

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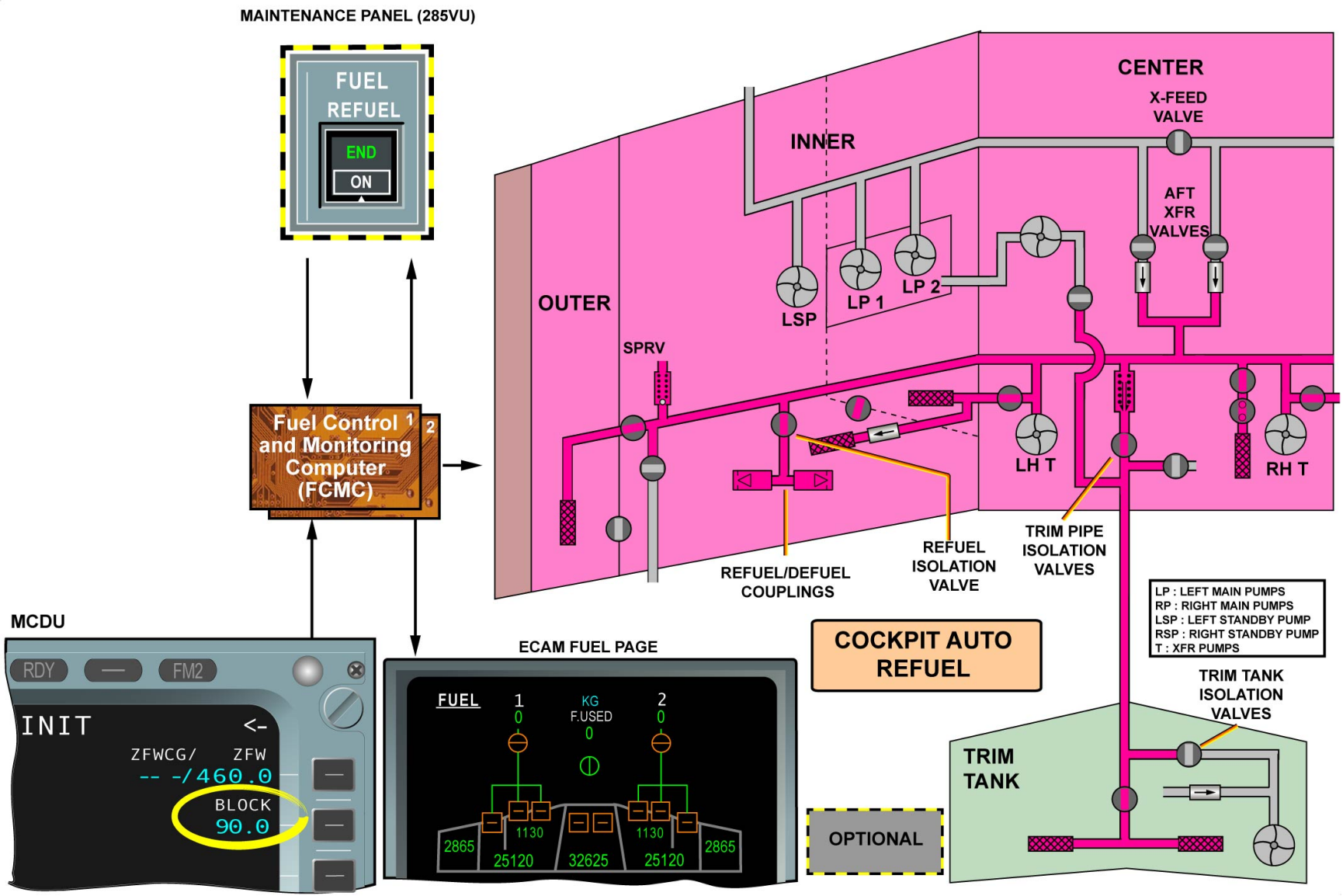

OPERATION - COCKPIT AUTOMATIC REFUEL

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REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

PRESSURE DEFUEL OPERATION

This procedure describes the defueling by pressure of the wing tanks only. However it is possible to pressure defuel all fuel tanks.
If a surge tank overflow sensor is "wet", it is not possible to start a pressure defuel. In that case, a suction defuel is required.

NOTE: Note: One or two defuel hoses can be used to do a pressure defuel. But if only one coupling is used, it must be the one identified by the "USE THIS ADAPTOR TO DEFUEL" marking.

To do a pressure defuel, on the refuel/defuel control panel the MODE SELECT switch is set to DEFUEL and the TRANSF.VALVE switch is set to OPEN.

NOTE: Note: When the MODE SELECT switch is set to DEFUEL, the high level protection of the FCMC is inhibited.

On the cockpit overhead FUEL panel:
- the X FEED valve P/BSW is set to ON,
- the STBY or MAIN engine fuel pumps are set to on,
- once the engine fuel pumps operate, the FCMC opens the aft transfer valves,
- the FCMC prevents any overbalance condition during defueling.

NOTE: Note: The FCMC prevents movement of fuel from the wing tanks (the aft transfer valves stay closed) until the trim tank is empty in order to prevent any overbalance condition.

Pushed by the pumps, the fuel flows to the couplings through the refuel/defuel gallery. When the fuel quantity in one inner tank decreases to 3500 kg, the inter-tank transfer valves open automatically. The fuel in the outer tanks is transferred by gravity to the inner tanks, and then pushed in the refuel/defuel gallery by the engine fuel pumps. The defueling process can be monitored on the ECAM FUEL page.

NOTE: Note: If the outer tanks are not to be defueled, both inter-tank transfer valve C/Bs (6QL1 & 6QL2) must be pulled.

At the end of the pressure defuel, the STBY and/or MAIN engine fuel pumps are set to OFF and the X FEED valve is closed. The FCMC closes both aft transfer valves. On the refuel/defuel panel, the TRANSF. VALVE switch is set to CLOSED and the MODE SELECT switch is set to OFF.

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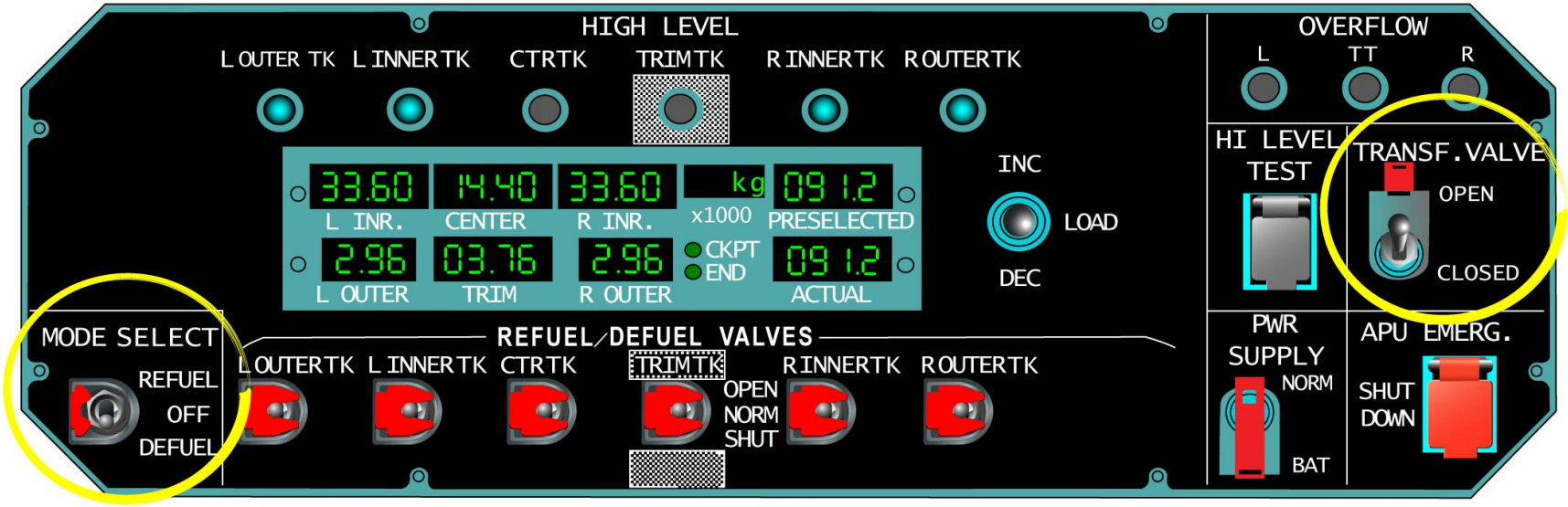
REFUEL/DEFUEL PANEL (990VU)



PRESSURE DEFUEL

OPERATION - PRESSURE DEFUEL OPERATION

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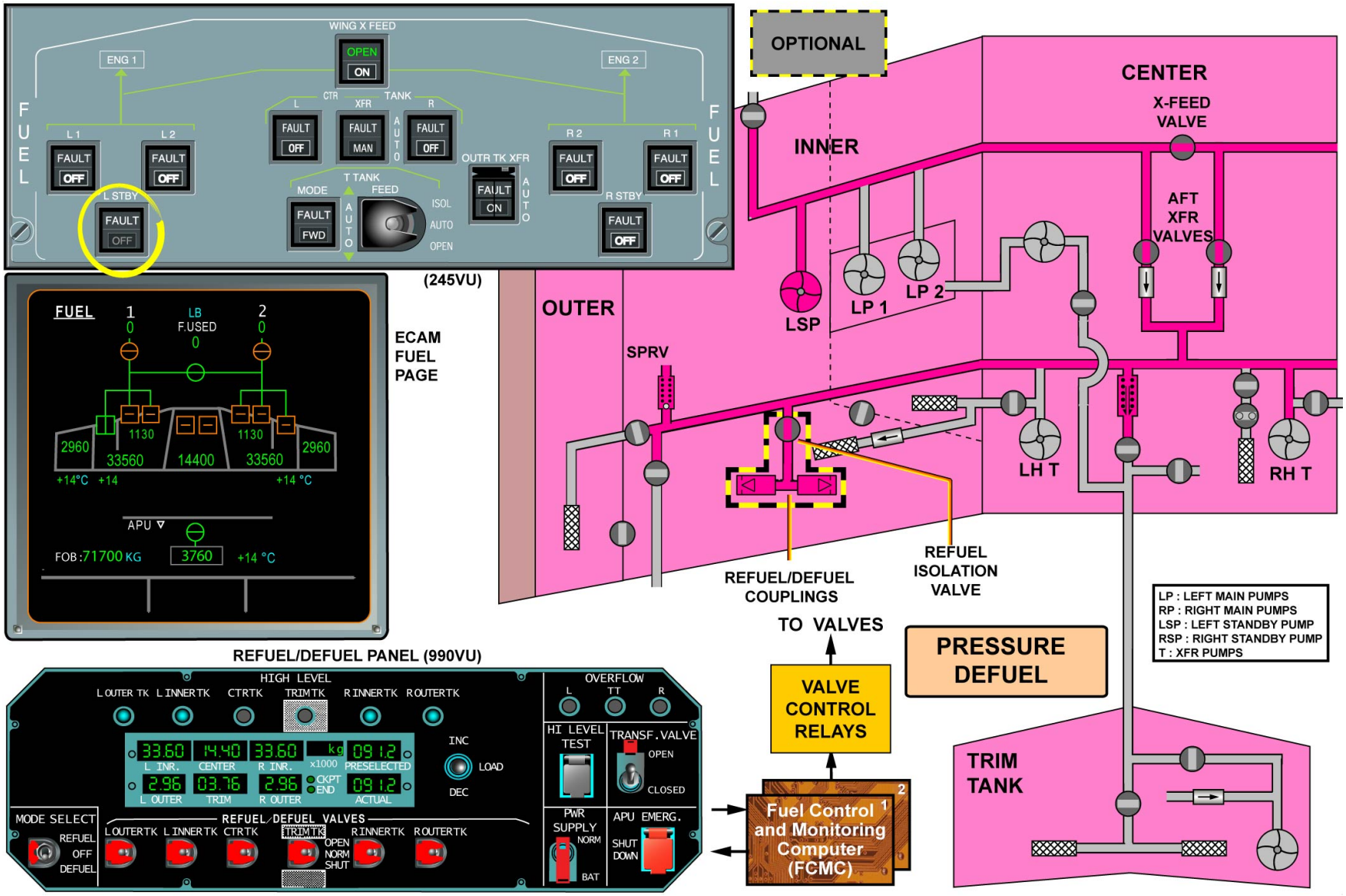

OPERATION - PRESSURE DEFUEL OPERATION

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REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

SUCTION DEFUEL OPERATION

This procedure describes defueling by suction of the wing tanks only. However, it is possible to suction defuel all fuel tanks.

NOTE: Note: The wing tanks cannot be defueled until the trim tank is empty.

On the refuel/defuel panel the MODE SELECT switch is set to DEFUEL, and the required fuel tank inlet valves are set to OPEN.

NOTE: Note: One or two defuel hoses can be used to do a pressure defuel. But if only one coupling is used, it must be the one identified by the "USE THIS ADAPTOR TO DEFUEL" marking.

The FCMC controls the refuel/defuel isolation valve solenoids. As soon as the suction motor of the fuel tanker is operating, the refuel/defuel isolation valve open by fuel suction. Each inlet valve selected OPEN on the refuel/defuel panel is controlled to open by the FCMC.

The suction defuel operation is monitored on the refuel/defuel panel. When completed, the REFUEL/DEFUEL VALVE switches are set back to NORM, and the MODE SELECT switch is set back to OFF.

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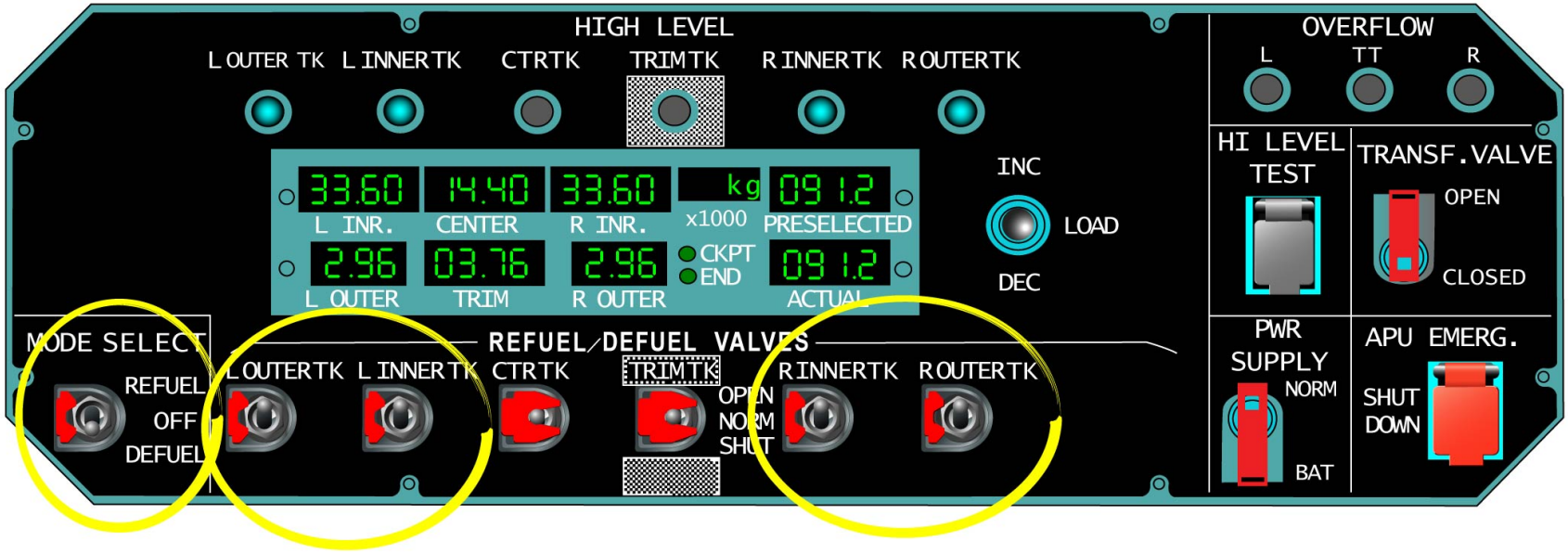
REFUEL/DEFUEL PANEL (990VU)



SUCTION DEFUEL

OPERATION - SUCTION DEFUEL OPERATION

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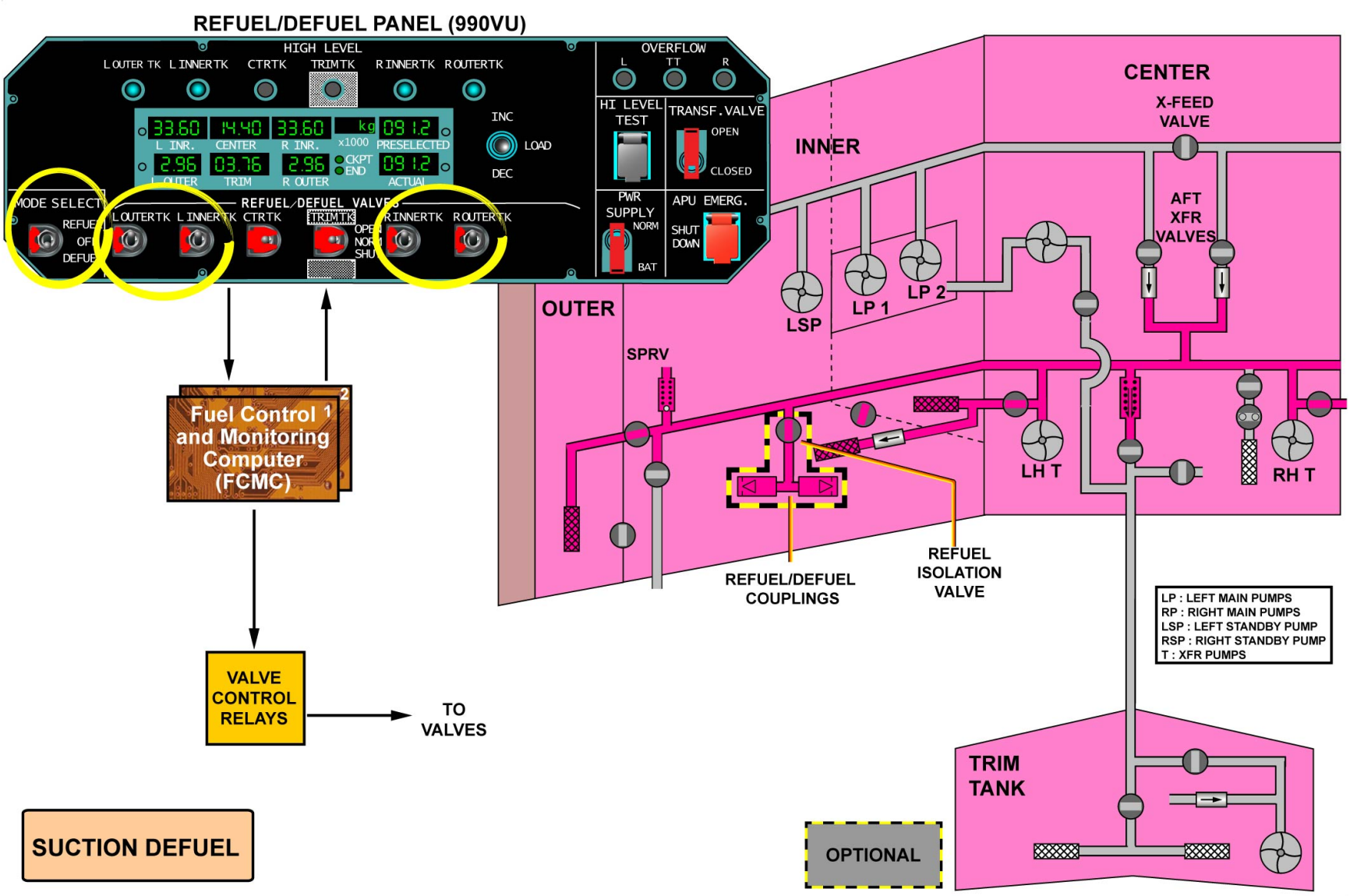

OPERATION - SUCTION DEFUEL OPERATION

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REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

INNER TANKS GROUND TRANSFERS

Ground transfer from tank to tank can be started from the refuel/defuel panel, except for a transfer to the trim tank. In this mode, the FCMC does not energize the refuel/defuel isolation valves and keeps the trim tank inlet valve closed. The FCMC hi-level protection is active. To start a ground transfer, actions from the cockpit and refuel/defuel panels are necessary. The following procedure describes a ground transfer between both wing inner tanks.

On the refuel/defuel panel:

- the REFUEL/DEFUEL VALVES switch for the tank to receive fuel is selected OPEN,
- the TRANSF. VALVE switch is set to OPEN,
- the MODE SELECT switch is set to REFUEL.

On the cockpit overhead FUEL panel:

- the X FEED valve P/BSW is set to ON,
- the STBY engine pump of the "supplier" inner tank is set to ON,
- once the engine pump runs, the FCMC opens the aft transfer valves,
- the fuel is thus pushed from the "supplier" inner tank through the crossfeed valve, both aft transfer valves and finally through the inlet valve of the "receiver" inner tank.

The inner tanks ground transfer is monitored from the ECAM FUEL page. When the inner tanks fuel quantity is at the required value, the engine STBY pump of the "supplier" tank is selected OFF and the X FEED valve P/BSW is selected OFF. On the refuel/defuel panel, the MODE SELECT switch is set to OFF, the REFUEL/DEFUEL VALVES switch of the "receiver" tank is set to NORM and the TRANSF. VALVE switch is set to CLOSED.

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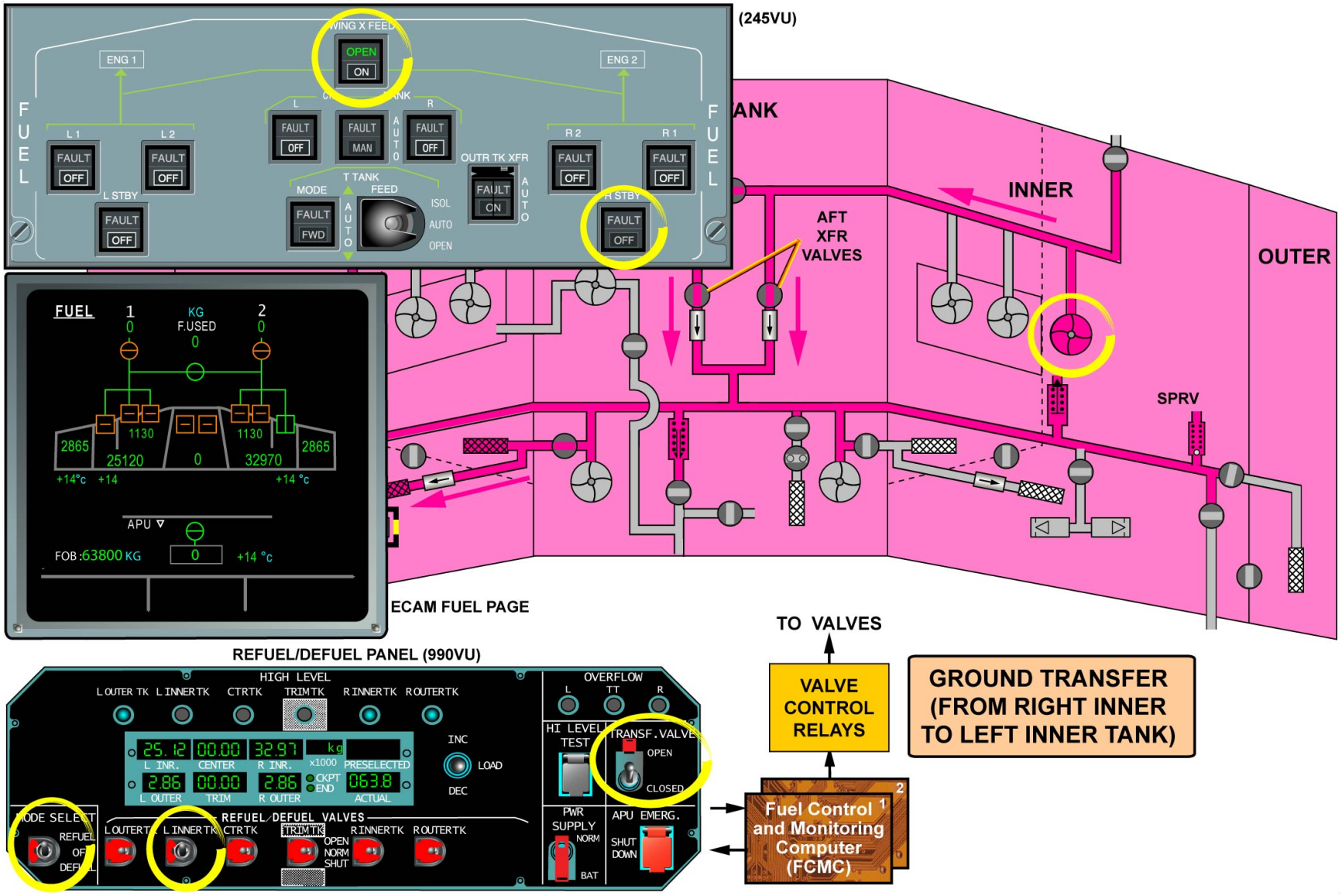

OPERATION - INNER TANKS GROUND TRANSFERS

G9409341 - GAUT0T0 - FM28D8000000003

REFUEL/DEFUEL D/O (A330-200)

OPERATION (continued)

CENTER TANKS GROUND TRANSFERS

A ground transfer from the center tank to inner tanks can also be done from the refuel/defuel panel. In this case, all the main and standby pumps must be selected OFF. On the refuel/defuel panel:
- the inner tanks REFUEL/DEFUEL VALVE switches are set to OPEN,
- the MODE SELECT switch is set to REFUEL,
The FCMC opens the inner tank inlet valves.
On the cockpit overhead FUEL panel, the LH and RH CTR TANK P/BSWs are pressed in. The FCMC controls both center tank transfer pumps to operate. The fuel is thus pushed from the center tank to the inner tanks. The ground transfer is monitored from the ECAM FUEL page. When the fuel quantities in the inner and center tanks are at the required value, both center transfer pumps are selected OFF. On the refuel /defuel panel, the MODE SELECT switch is set to OFF and the inner tank REFUEL/DEFUEL VALVE switches are set to NORM.

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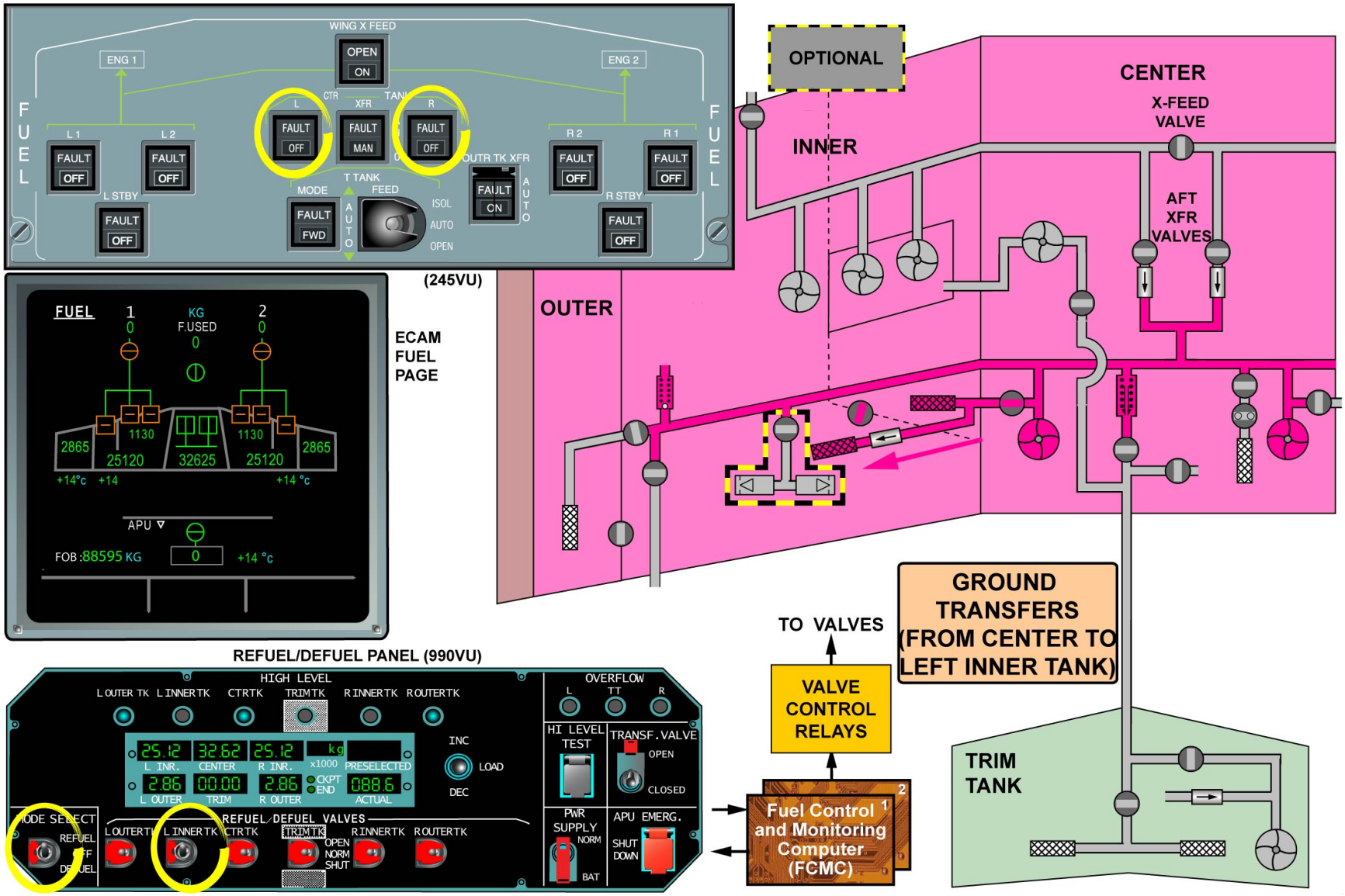

OPERATION - CENTER TANKS GROUND TRANSFERS

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REFUEL/DEFUEL D/O (A330-300)

GENERAL

There are three different procedures to refuel the A/C, the pressure refuel in automatic or in manual mode, and the overwing refuel. The A/C has two refuel couplings (optional on the left wing), with two refuel hose adaptors on each coupling. The A/C can be refueled through one or more of the refuel hose adaptors. When four refuel hoses are in use, the minimum time to pressure refuel the A/C, from empty tanks to maximum fuel capacity, is approximately 35 minutes. The refuel pressure at the refuel hoses must not exceed 50 psi. There are two procedures to defuel the A/C, the pressure defuel using the A/C fuel pumps and the suction defuel using an external suction device (11 psi max.). The A/C can be defueled through one or more of the refuel hose adaptors. But when only one adaptor on a refuel/defuel coupling is used, it must be the one identified by the "USE THIS ADAPTOR TO DEFUEL" marking. These two procedures can be used at the same time to increase the defuel rate.
Refuel/defuel operations are initiated from the refuel/defuel control panel or optionally from the cockpit REFUEL panel, for automatic refuel only.
The refuel/defuel control panel is located in the RH side of the belly fairing. A similar control panel may be installed as an option, next to the refuel/defuel couplings, at the bottom of the wing leading edge (either or both wings).
Ground transfers from tank to tank except to trim tank, can be initiated from the refuel/defuel control panel.
The Fuel Control and Monitoring Computer (FCMC) gives an overflow protection by closing the refuel/defuel isolation valves and stopping any type of refuel/defuel or ground transfer operation in case any of the overflow sensors (installed in surge tanks) becomes wet. The FCMC supplies the set quantity of fuel in the different tanks so that no hazardous overbalance condition occurs in all modes of fuel operation.

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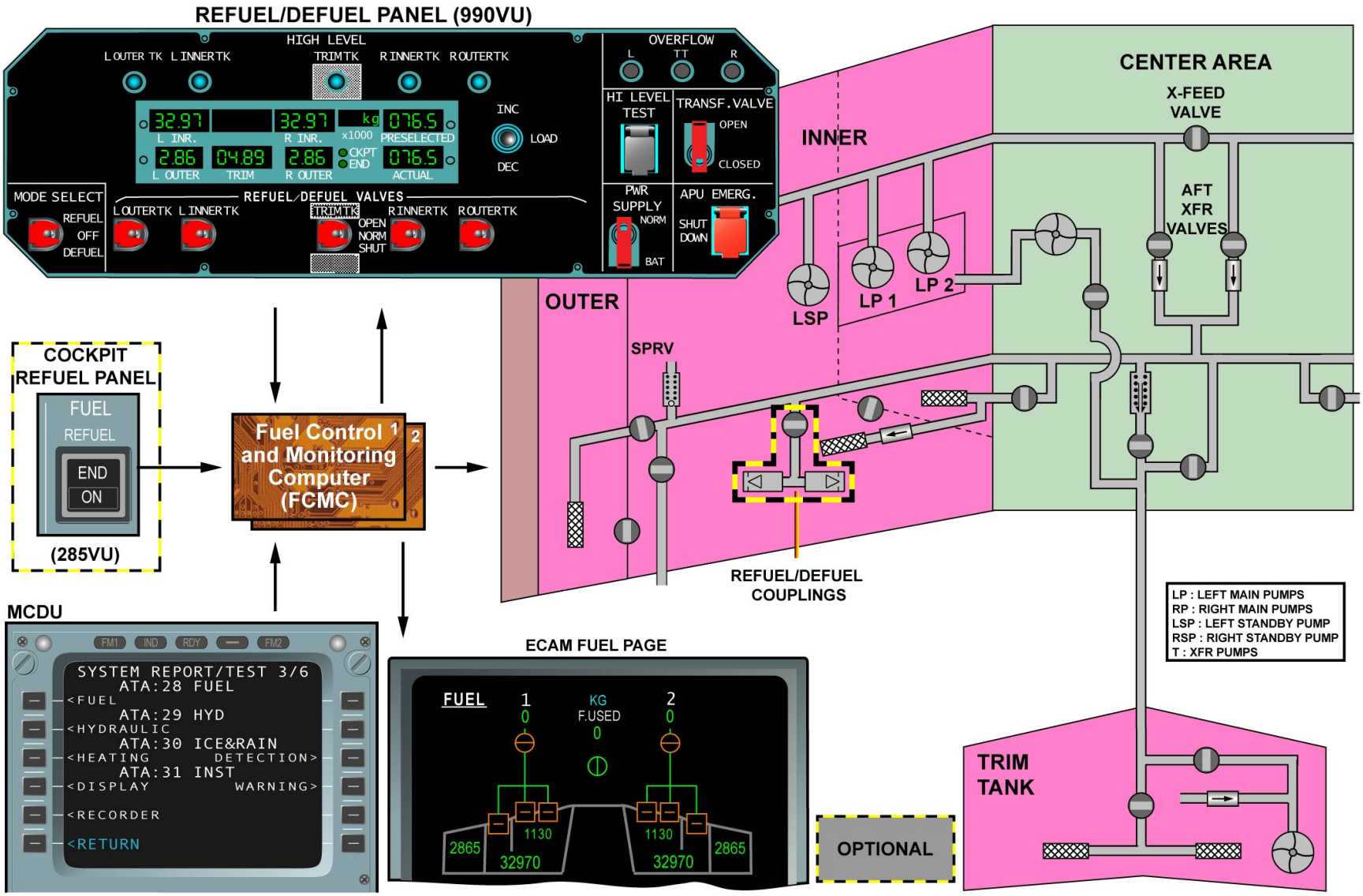
REFUEL/DEFUEL PANEL (990VU)
HIGH LEVEL
L OUTER TK
L INNER TK
TRIM TK
R INNER TK
R OUTER TK
OVERFLOW
L
TT
R
HI LEVEL TEST
TRANSF. VALVE
OPEN
CLOSED
INC
LOAD
DEC
L INR.
R INR.
x1000
PRESELECTED
L OUTER
TRIM
R OUTER
CKPT
END
ACTUAL
MODE SELECT
REFUEL
OFF
DEFUEL
REFUEL/DEFUEL VALVES
PWR SUPPLY
NORM
BAT
APU EMERG.
SHUT DOWN
OPEN
NORM
SHUT
COCKPIT REFUEL PANEL
FUEL
REFUEL
END
ON
(285VU)
Fuel Control and Monitoring Computer (FCMC)
1
2
MCDU
SYSTEM REPORT/TEST 3/6
ATA:28 FUEL
<FUEL
ATA:29 HYD
<HYDRAULIC
ATA:30 ICE&RAIN
<HEATING
DETECTION>
ATA:31 INST
<DISPLAY
WARNING>
<RECORDER
<RETURN
ECAM FUEL PAGE
FUEL
KG
F.USED
2865
1130
32970
OPTIONAL
CENTER AREA
X-FEED VALVE
INNER
OUTER
AFT XFR VALVES
LSP
LP 1
LP 2
SPRV
REFUEL/DEFUEL COUPLINGS
TRIM TANK
LP : LEFT MAIN PUMPS
RP : RIGHT MAIN PUMPS
LSP : LEFT STANDBY PUMP
RSP : RIGHT STANDBY PUMP
T : XFR PUMPS

GENERAL

REFUEL/DEFUEL D/O (A330-300)

DESCRIPTION

Here is a description of the refuel/defuel system in different conditions.

REFUEL/DEFUEL CONTROL PANEL

The primary components of the refuel/defuel control panel are:
- the PoWeR SUPPLY (NORM/BAT) switch, allowing refuel/defuel on batteries HOT BUS power supply if there is no normal supply,
- the HI LEVEL TEST switch,
- the APU EMERGency SHUTDOWN switch,
- the preselect (LOAD select) switch, used for automatic refuel only,
- the MODE SELECT switch secured in OFF position
- the REFUEL/DEFUEL VALVES switches secured in NORM position,
- the refuel indicator panel.

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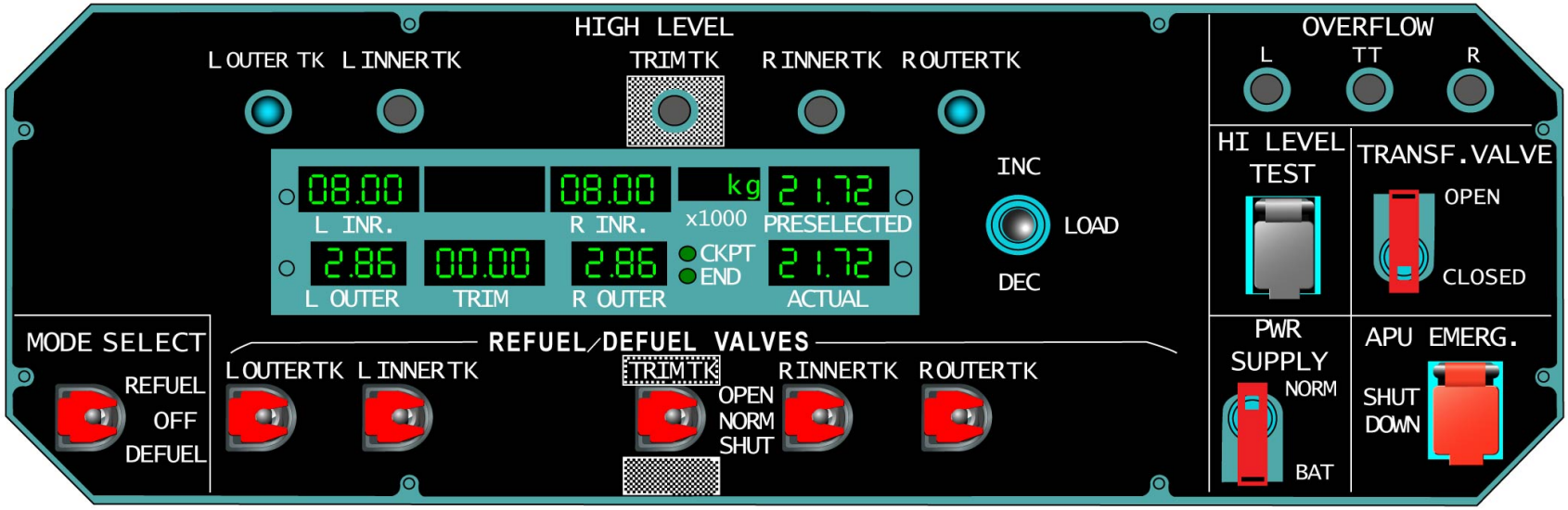
REFUEL/DEFUEL PANEL (990VU)



DESCRIPTION - REFUEL/DEFUEL CONTROL PANEL

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REFUEL/DEFUEL D/O (A330-300)

DESCRIPTION (continued)

REFUEL/DEFUEL COUPLINGS

One refuel/defuel coupling is installed on the RH wing. One additional coupling is installed as an option on the LH wing. Each coupling is attached to the front face of the wing front spar. Each refuel/defuel coupling has a Y-shaped hollow body, with a circular housing in the center receiving the refuel isolation valve. Each refuel/defuel coupling is equipped with two refuel adaptors. Each refuel adaptor is protected by a removable cap.

REFUEL ISOLATION VALVES

The refuel isolation valve is electrically controlled via a solenoid and is hydraulically operated. When the valve is energized and a fuel pressure is supplied, the isolation valve opens. The isolation valve has a manual override button that can be used to open the valve in case of electrical or solenoid failure. The refuel isolation valve is installed in the center of each refuel/defuel coupling.

OUTER, INNER, TRIM INLET VALVES AND ACTUATORS

All inlet valves are of the ball valve type and are operated by a single DC motor actuator installed with a visual open/close indicator. They are connected to the refuel/defuel gallery and let fuel distribution to the various tanks by dedicated supply lines.
Two outer tank inlet valves, one for each outer tank, are installed in the inner tanks and attached to the front face of the wing rear spar. Their electrical actuators are installed on the rear face of this spar.
Inner tank inlet valves are installed in the fuel supply line to both inner tanks. These valves are installed in the center fuselage area and attached to the front face of the center fuselage rear spar. Their actuators are attached to the rear face of this spar.
A trim tank inlet valve is installed into the trim tank and its actuator is attached under the bottom skin.

EMERGENCY ISOLATION VALVES

The emergency isolation valves are of the ball valve type, each one operated by two DC motor actuators. One valve is installed in each inner tank and its actuator is attached to the wing rear spar. During normal operation, both emergency isolation valves are open to let fuel quantity balancing between the FWD section and the AFT section of each inner tank.

CHECK VALVES

Two check valves prevent fuel flow from the refuel gallery to the engine feed gallery in case any aft transfer valve is stuck in the open position.

REFUEL DIFFUSERS

The fuel is delivered into the fuel tanks through diffusers.

SURGE-PRESSURE RELIEF VALVE

During refueling, two surge-pressure relief valves prevent pressure surge into the refuel gallery. If the fuel pressure is more than 65 psi the valve opens to decrease the pressure in the gallery.

DEPRESSURIZING VALVE

A depressurizing valve isinstalled on the refuel gallery in the right inner tank only. After refuel operation is completed, the depressurizing valve releases the remaining pressure in the refuel gallery into the right inner tank. The valve operates between 2 and 3 psi.

RESTRICTOR VALVE

A one-way restrictor valve is installed on the refuel gallery upstream of the trim pipe isolation valve. It decreases the fuel flow directed to the trim tank and lets the fuel flow freely in the opposite direction.

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REFUEL GALLERY LOW-PRESSURE SWITCH

A LP switch, attached to the center fuselage rear spar, detects any LP condition (below 6 psi) in the refuel gallery. If a low pressure condition is detected during refueling of trim tank with the APU running (fed by the AFT APU pump), the trim transfer line is isolated. The refueling of the trim tank is temporarily stopped and the APU is fed by the FWD APU pump, until the LP condition disappears.

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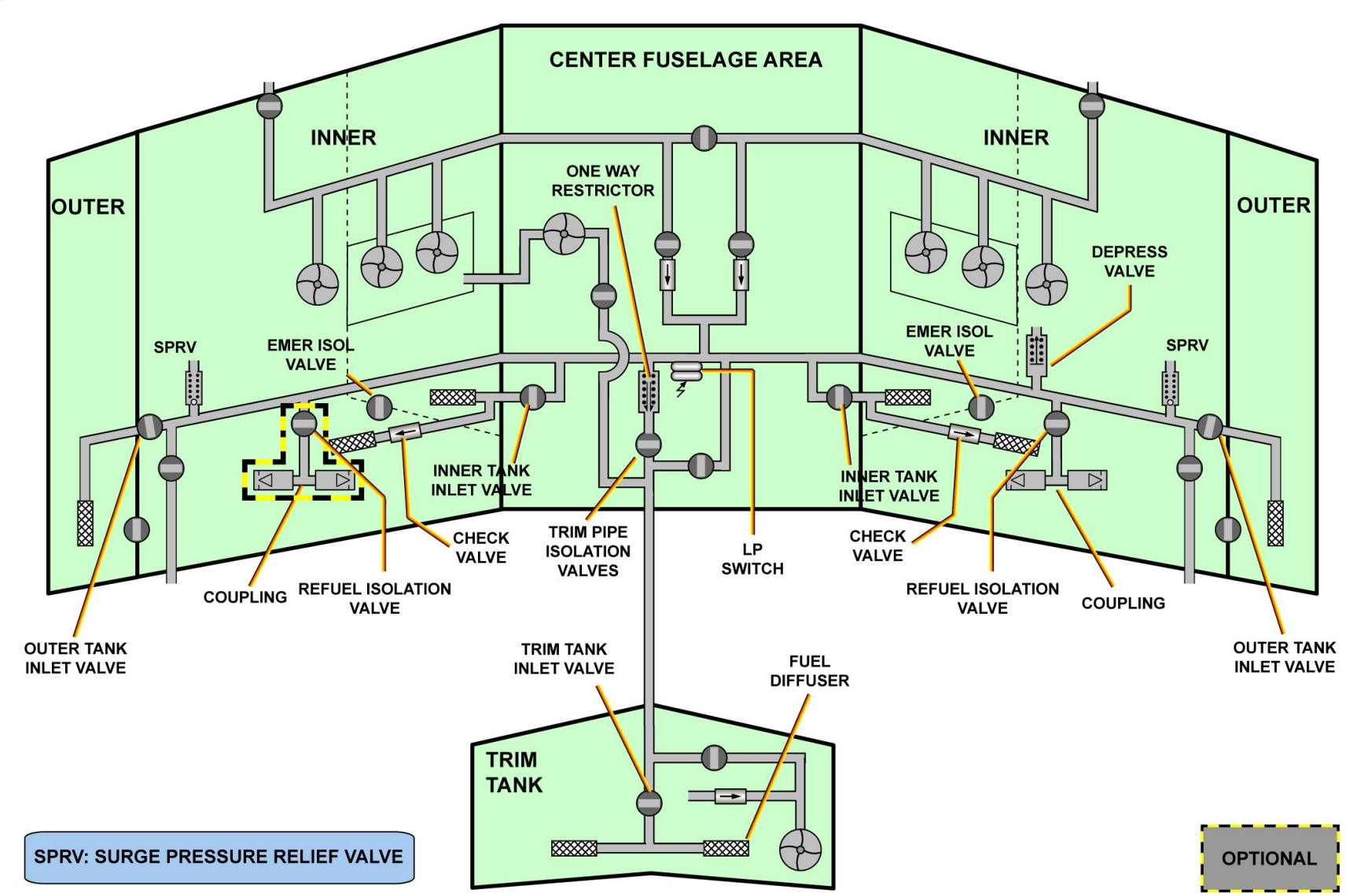

DESCRIPTION - REFUEL/DEFUEL COUPLINGS ... REFUEL GALLERY LOW-PRESSURE SWITCH

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REFUEL/DEFUEL D/O (A330-300)

OPERATION

When the quick-release door of the refuel/defuel control panel is open, a door operated microswitch sends a signal to the FCMCs to supply the refuel/defuel electrical circuits. Once the refuel/defuel panel is powered, any refuel, defuel or ground transfer can be initiated.
The Air Data Inertial Reference Systems (ADIRS) are set to NAV so that the FCMCs receive the A/C attitude information required for an optimization of the tanks fuel quantity calculation accuracy.

NOTE: Note: If external electrical power or APU electrical power is not available, it is possible to use A/C batteries to do a refueling. But on batteries, the ADIRS do not send A/C attitude information to the FCMCs. Therefore after a refuel on batteries, there could be a difference of up to 750 kg between the set fuel quantity and the actual fuel quantity.

HI-LEVEL TEST

When the HI LEVEL TEST P/BSW guard is pushed in and held, it sends a signal to the FCMCs which do a continuity test of the high-level and overflow sensors and their circuits. If these are serviceable the FCMCs change the HIGH LEVEL blue lights and the OVERFLOW amber lights to their opposite condition. In addition the CKPT and END lights come on and the fuel quantity, PRESELECTED for Preselected Fuel Quantity (PFQ) and ACTUAL for Fuel On Board (FOB) show all 8's. At the same time, the FCMC tests the inlet valves operation and checks the continuity of the refuel isolation valves circuit.
When the HI LEVEL TEST P/BSW is released out, the following lights has to be checked:
- the HIGH LEVEL and OVERFLOW lights go back to their initial condition,
- the fuel quantity, PRESELECTED (PFQ) and ACTUAL (FOB) displays go back to their initial values,
- the CKPT and END lights go off.

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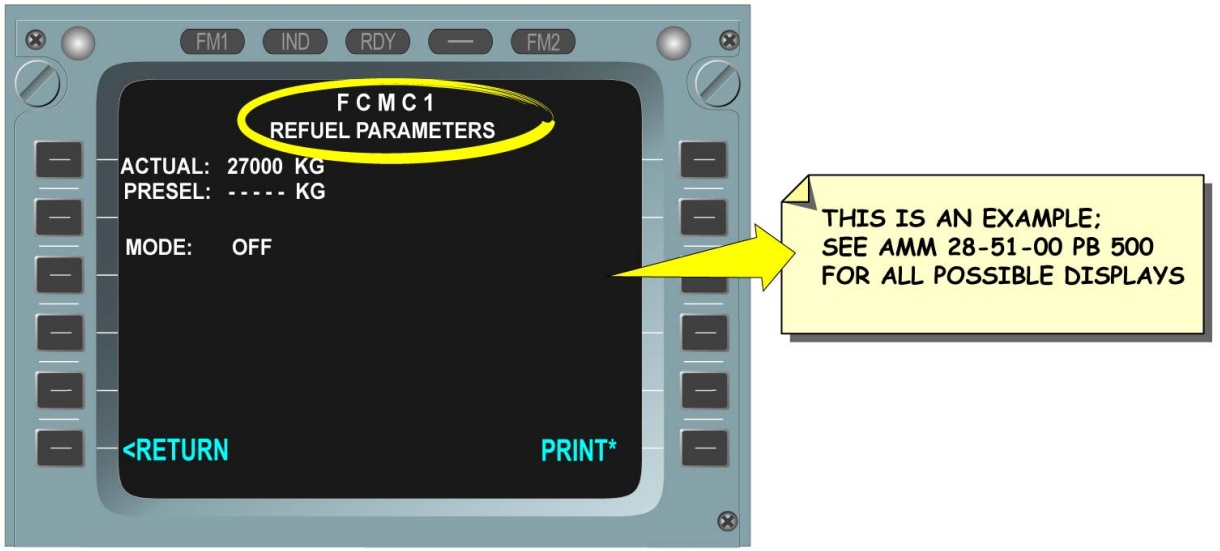
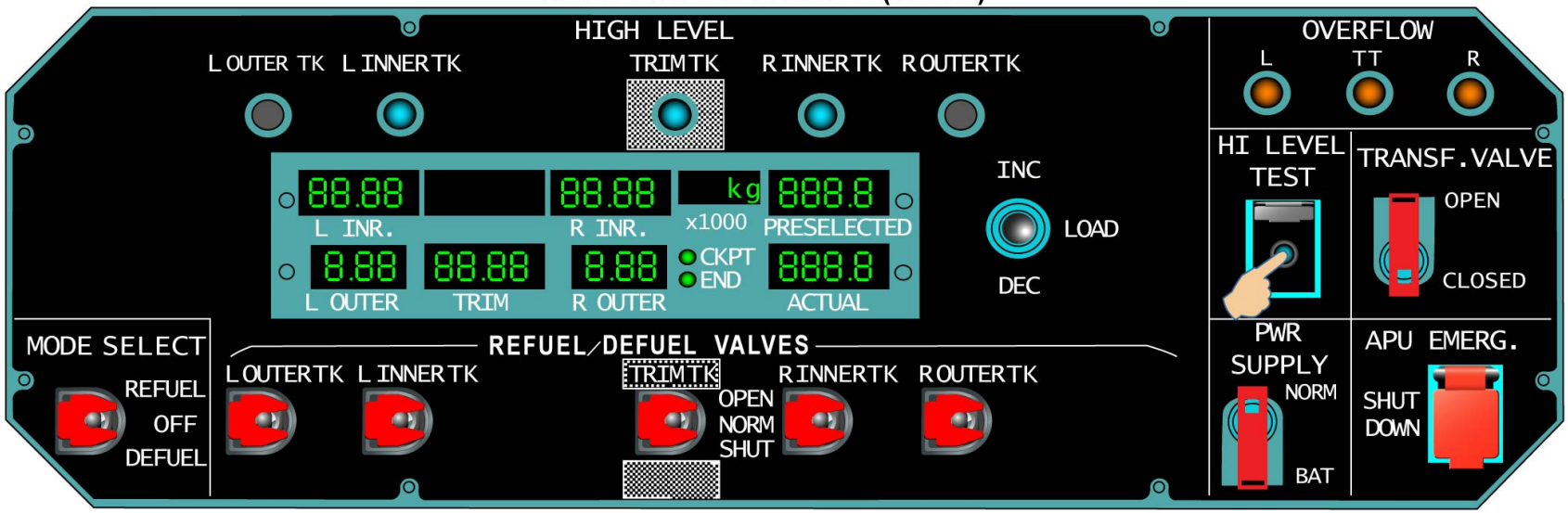


REFUEL/DEFUEL PANEL (990VU)



OPERATION - HI-LEVEL TEST

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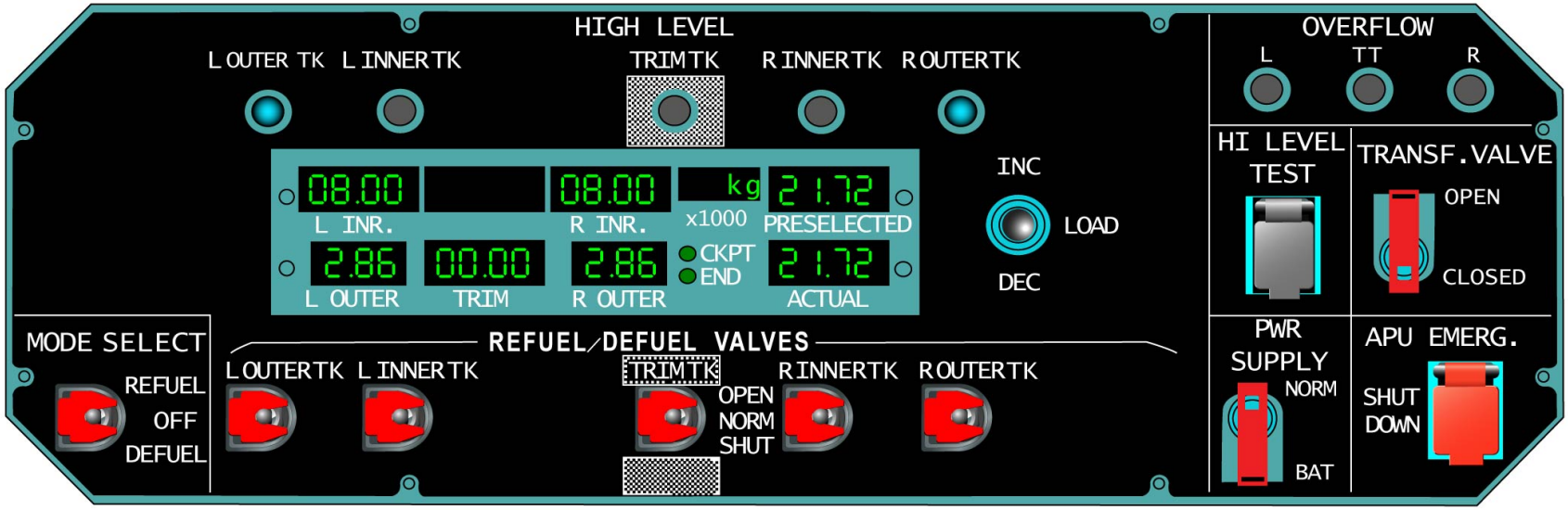
REFUEL/DEFUEL PANEL (990VU)



OPERATION - HI-LEVEL TEST

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REFUEL/DEFUEL D/O (A330-300)

OPERATION (continued)

AUTOMATIC PRESSURE REFUEL

During an automatic refuel and after the high level test, the PRESELECTED switch is used to preselect the fuel quantity on the PRESELECTED display. To initiate a refuel, this quantity must be set to a greater value than the ACTUAL indication by more than 200 kg.

The FCMCs receive this preselection and refer to the memorized post-refuel distribution chart to select the tanks to be refueled and to calculate their respective fuel quantity target.

When the MODE SELECT switch is set to REFUEL, the FCMC supplies 28 VDC to the refuel/defuel isolation valve solenoids. When a refuel pressure is supplied, the isolation valves hydraulically open and let the fuel go into the refuel/defuel gallery. Then, the FCMC controls all the tank inlet valve relays involved in the refueling from the distribution chart. The involved tanks are refueled simultaneously.

As the individual tank fuel quantity increases, the FCMC will close the related inlet valve when the fuel tank quantity target is reached or the high-level sensors become wet.

At the end of the refuel, the END light comes on steady to indicate a complete successful refueling. The MODE SELECT switch is set to OFF and the refuel isolation valve closes.

An automatic refuel may not start or may be aborted by the FCMC if any of the following conditions is met:

- "BLOCK" fuel value entered in MCDU "INIT" page,
- OUTR TK XFR or T TANK MODE P/BSW not in AUTO mode,
- any REFUEL/DEFUEL VALVES switch not in NORM position,
- any inlet valve position disagree with FCMC command,
- any surge tank overflow fuel sensor becomes wet,
- any jettison valve is detected open (if installed),
- any high level sensor failure,
- any tank fuel quantity indication function inoperative.

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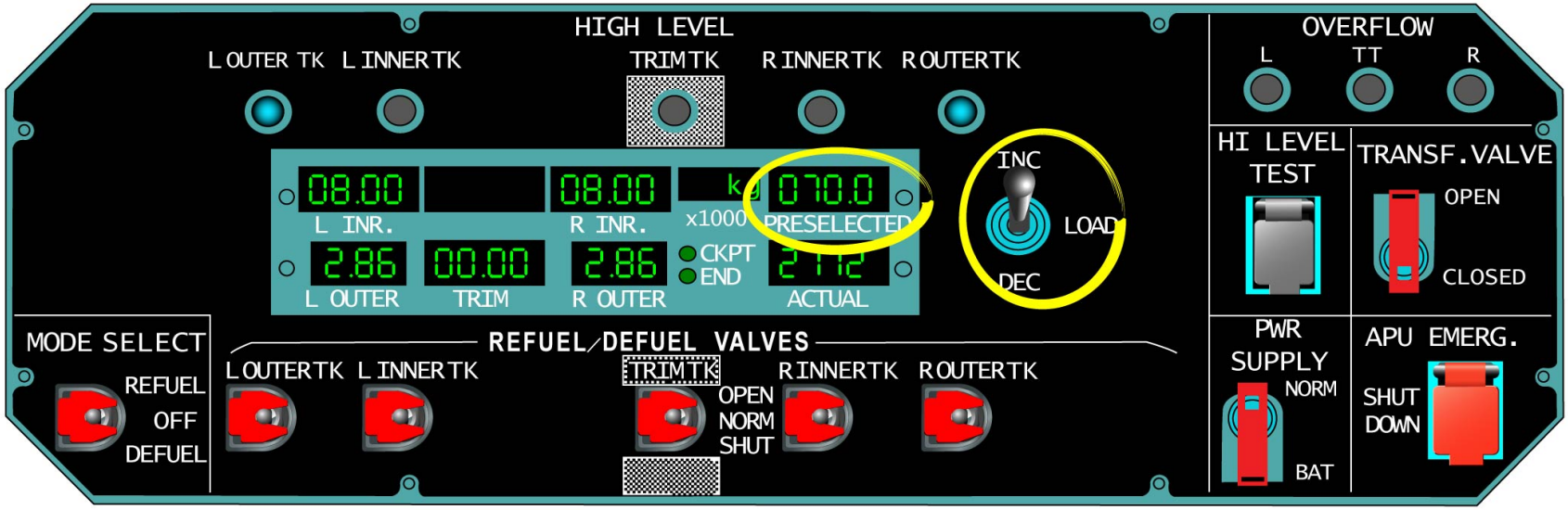
REFUEL/DEFUEL PANEL (990VU)



OPERATION - AUTOMATIC PRESSURE REFUEL

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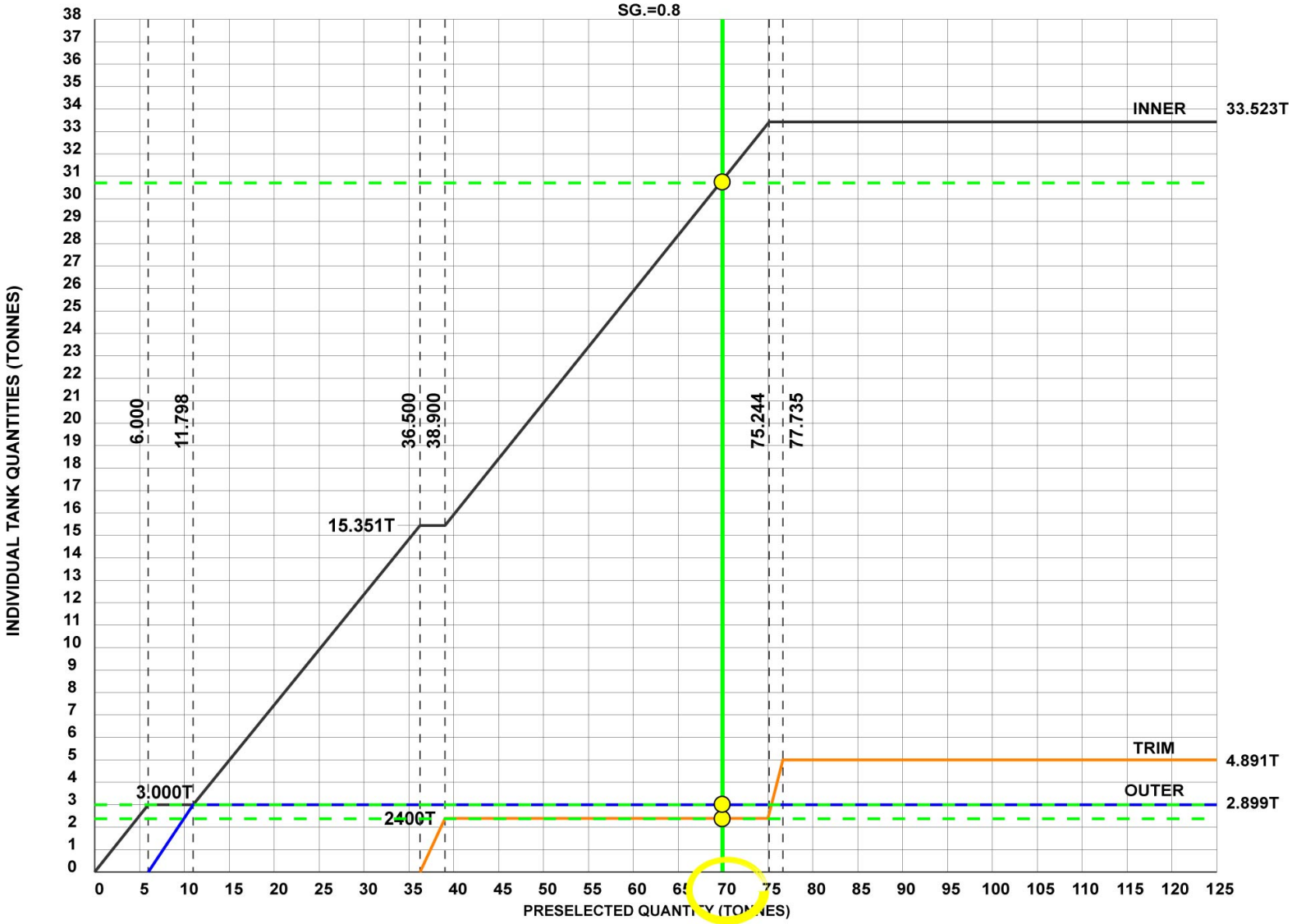

OPERATION - AUTOMATIC PRESSURE REFUEL

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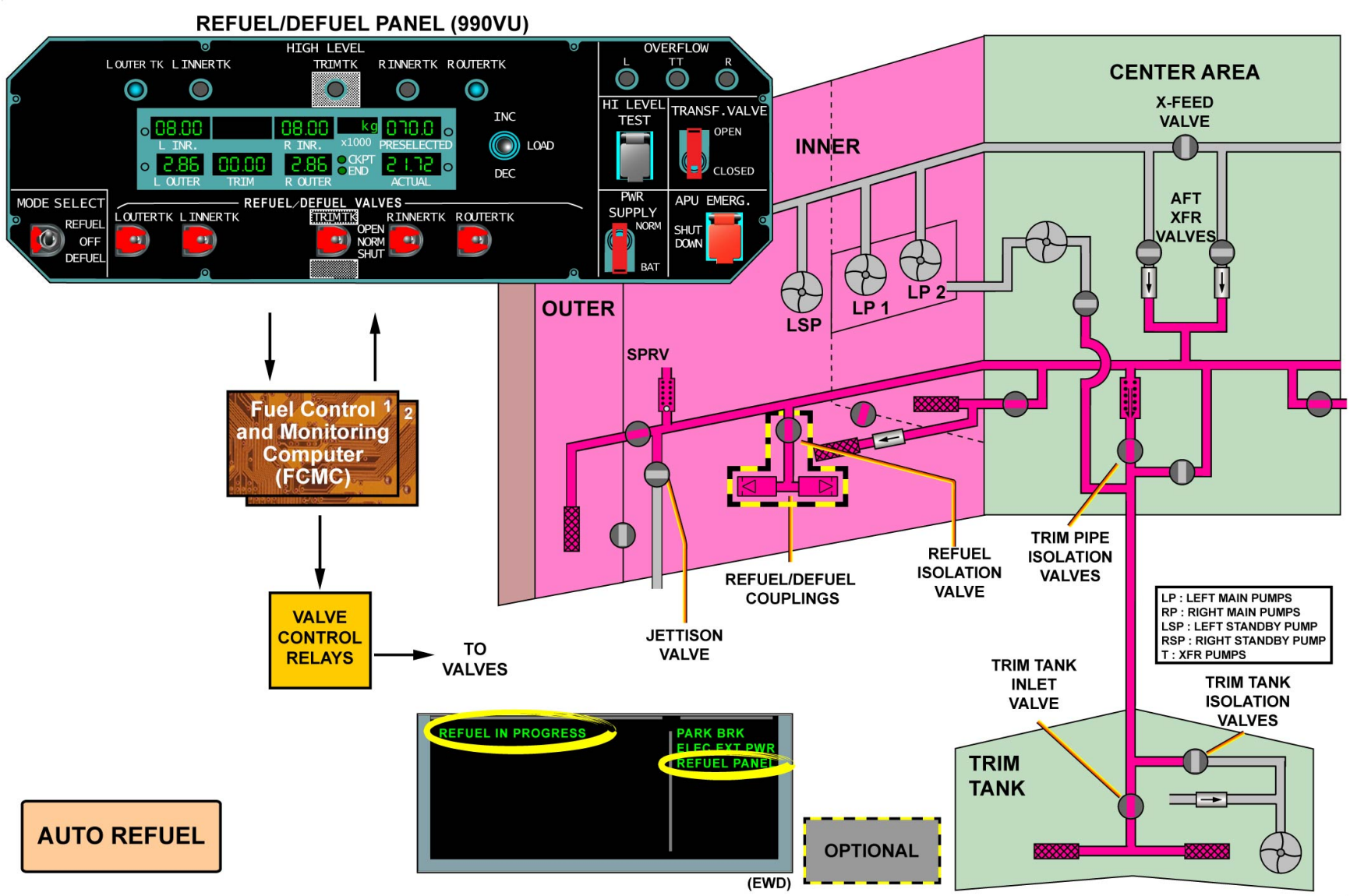

OPERATION - AUTOMATIC PRESSURE REFUEL

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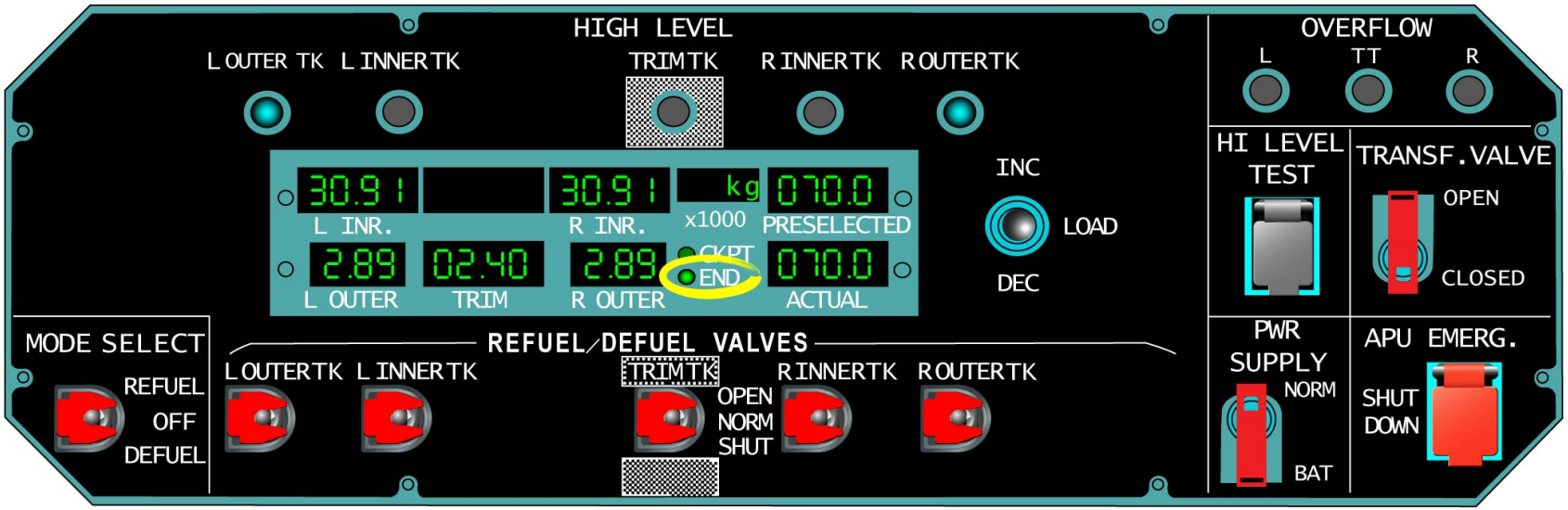
REFUEL/DEFUEL PANEL (990VU)



AUTO REFUEL

OPERATION - AUTOMATIC PRESSURE REFUEL

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REFUEL/DEFUEL D/O (A330-300)

OPERATION (continued)

REFUEL ABORT

The refuel process is aborted in case of:
- MAN XFR selection, or
- Inlet valve failure or high level test failure, or
- Overflow detection with an amber light on the refuel/defuel panel.

In this case, the FCMCs abort the refuel, the MCDU displays the refuel parameters and the END LIGHT on the refuel/defuel panel flashes.

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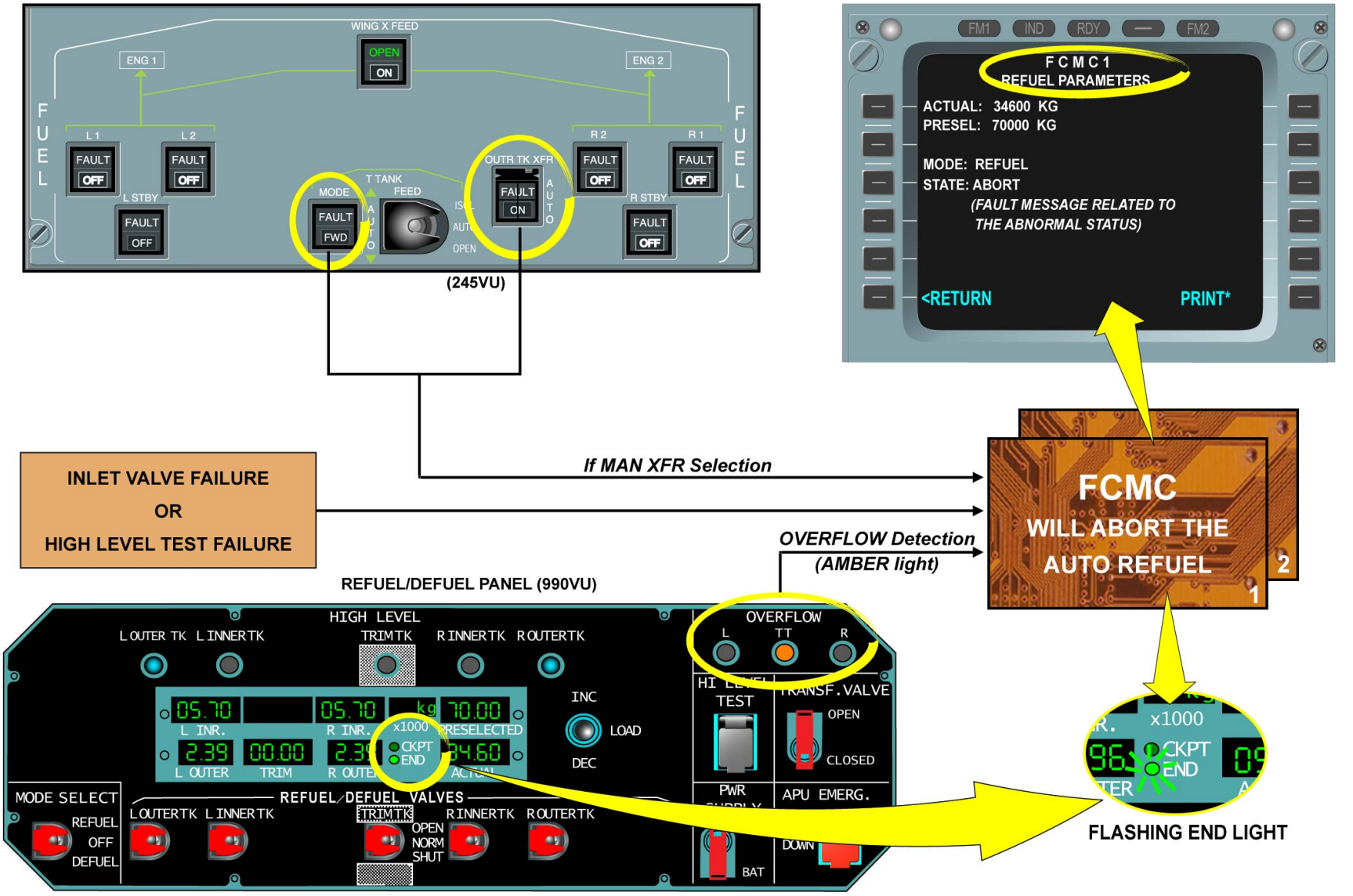

OPERATION - REFUEL ABORT

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REFUEL/DEFUEL D/O (A330-300)

OPERATION (continued)

MANUAL PRESSURE REFUEL

A manual refuel procedure is only required when an automatic refuel aborts due to a system failure. On the refuel/defuel panel, the PRESELECTED quantity must be set to zero or 500 kg below the ACTUAL quantity. The REFUEL/DEFUEL VALVES switches of the tanks to be refueled are set to OPEN and the REFUEL/DEFUEL VALVES switches of the tanks not to be refueled are set to SHUT. The MODE SELECT switch is then set to REFUEL position to send a signal to the FCMC, which connects a 28 VDC supply to the solenoid of the refuel isolation valves. If refuel pressure is available, the refuel isolation valves open. The involved tanks are refueled simultaneously.

NOTE: Note: The refueling distribution chart, shown in the automatic refuel subtopic, can be referred to (through the AMM) to ensure optimization of fuel distribution during manual refueling.

Each inlet valve can be closed manually, by moving the related REFUEL/DEFUEL VALVES switch to SHUT or NORM, but the FCMC automatically closes the inlet valve when the related hi-level sensors become wet. All the selected fuel tanks are normally refueled at the same time, except when the FCMC applies the overbalance protection.

To keep a safe longitudinal balance, the trim tank inlet valve will not open unless one of these conditions is met:

- the two inner tanks fuel quantities are above 14000 kg,
- one inner tank fuel quantity is above 14000 kg and the other inner tank inlet valve is open,
- the two inner tank inlet valves are open.

At the end of the refuel, the MODE SELECT switch is set to OFF, the refuel isolation valves close.

A manual refuel may not start or may be aborted by the FCMC if any of the following conditions is met:

- OUTR TK XFR or T TANK MODE P/BSW not in AUTO mode,
- any surge tank overflow fuel sensor becomes wet,
- any jettison valve is detected open,
- any high level sensor failure.

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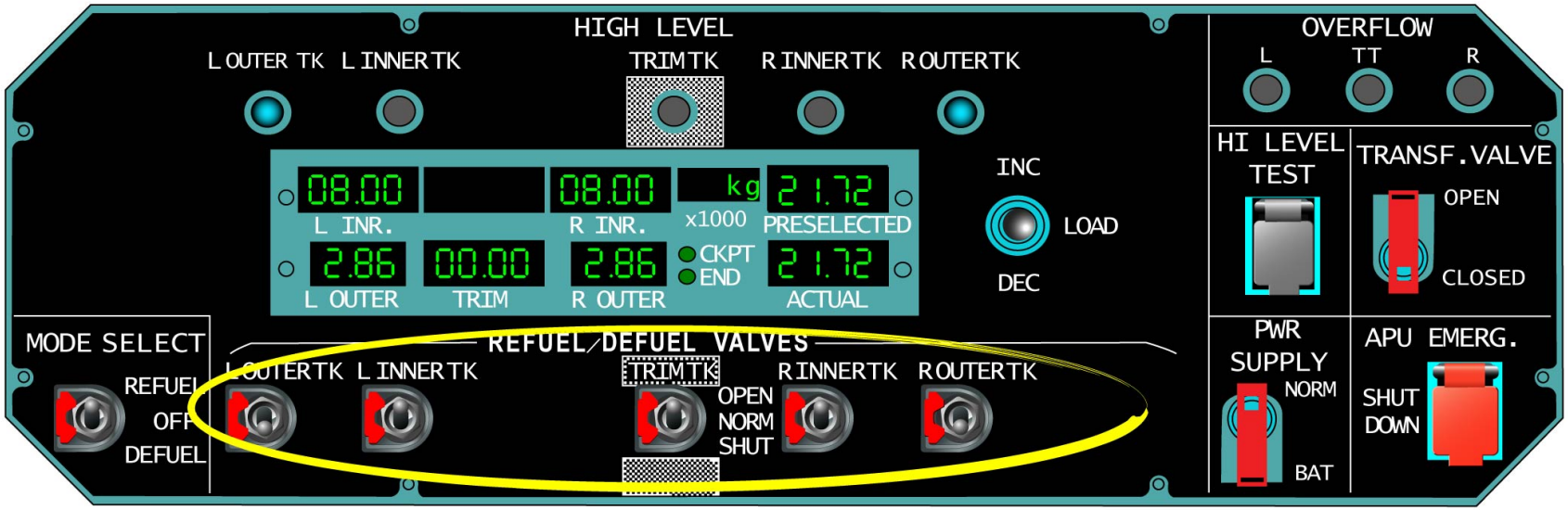
REFUEL/DEFUEL PANEL (990VU)



MANUAL REFUEL

OPERATION - MANUAL PRESSURE REFUEL

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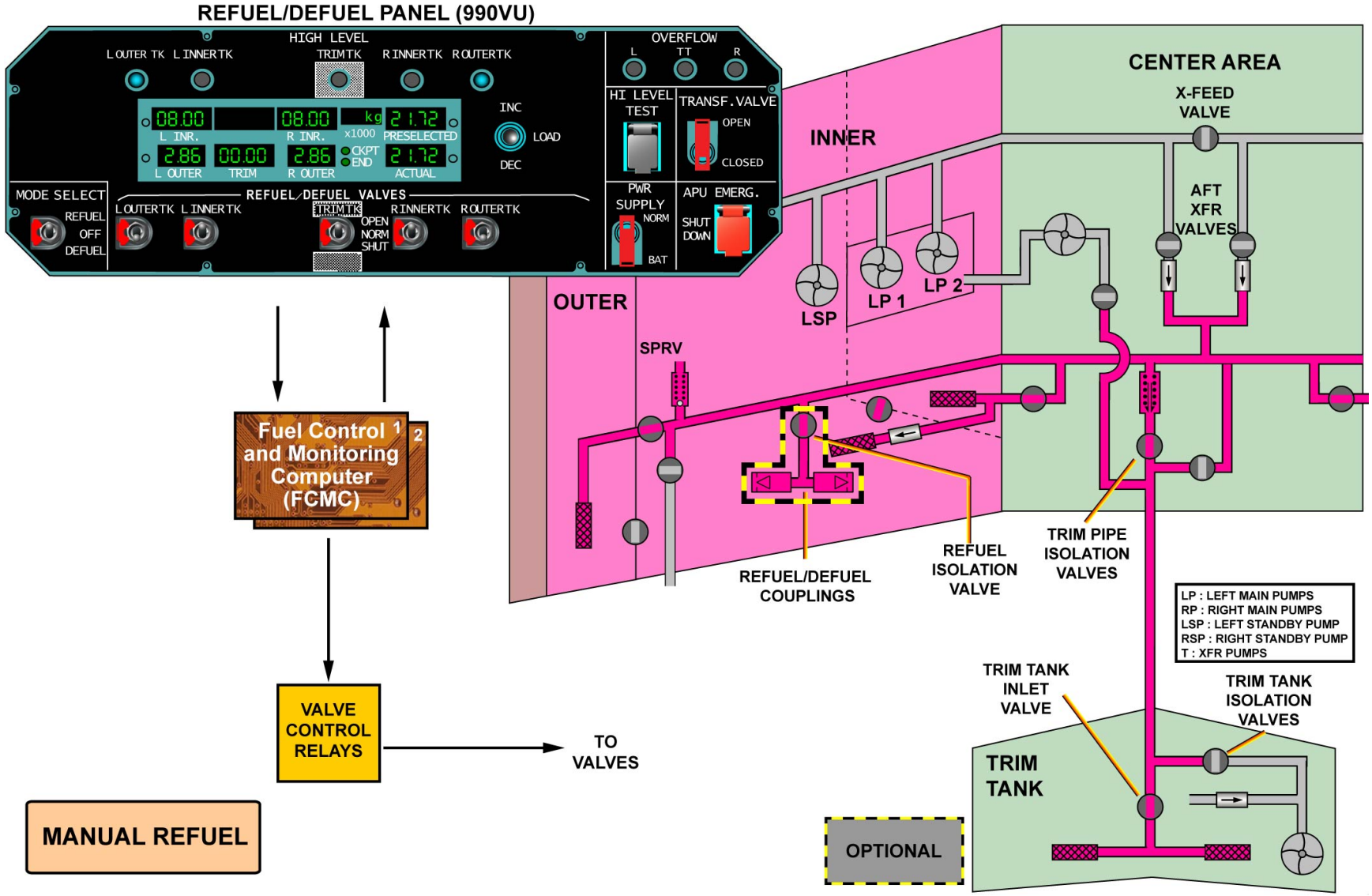

OPERATION - MANUAL PRESSURE REFUEL

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REFUEL/DEFUEL D/O (A330-300)

OPERATION (continued)

COCKPIT AUTOMATIC REFUEL

Optionally, it is possible to do an automatic refuel from the cockpit. The necessary total fuel quantity must be entered via the MCDU as a BLOCK fuel on the INIT page 2. The quantity must be a minimum of 200 kg more than the FOB quantity shown on the ECAM FUEL page.

On the cockpit REFUEL panel, when the REFUEL P/BSW is pressed in, the ON white light comes on and the master FCMC does an automatic high level test. Then, if the test is OK, the FCMC starts the automatic refuel. If the high level test fails, the green END light will flash in the REFUEL P/BSW.

When the refuel is complete and correct, the green END light comes on steady in the REFUEL P/BSW.

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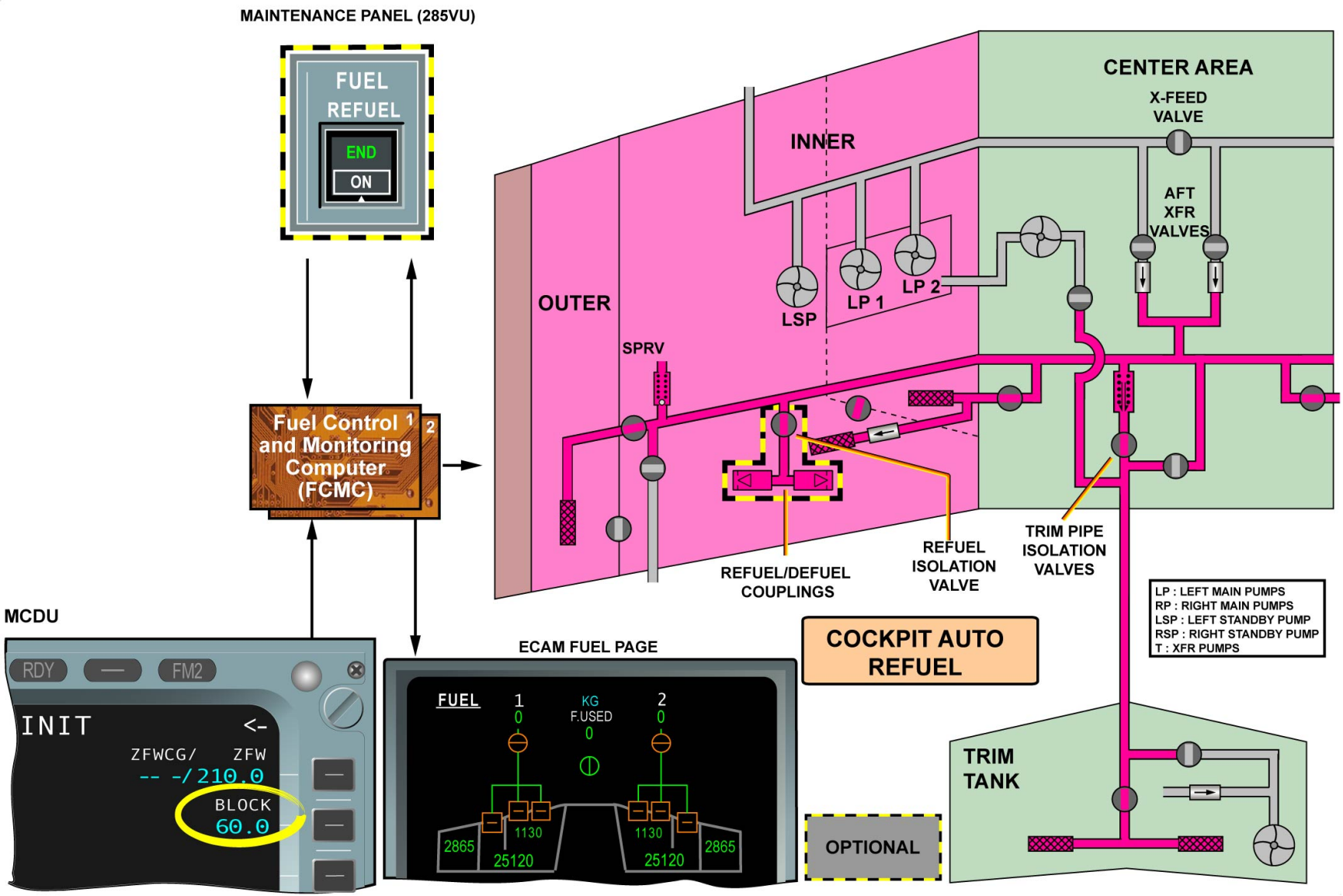

OPERATION - COCKPIT AUTOMATIC REFUEL

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REFUEL/DEFUEL D/O (A330-300)

OPERATION (continued)

PRESSURE DEFUEL OPERATION

This procedure describes the defueling by pressure of the wing tanks only. However it is possible to pressure defuel all fuel tanks.
If a surge tank overflow sensor is "wet", it is not possible to initiate a pressure defuel. In that case, a suction defuel is required.

NOTE: Note: One or two defuel hoses can be used to do a pressure defuel. But if only one coupling is used, it must be the one identified by the "USE THIS ADAPTOR TO DEFUEL" marking.

To do a pressure defuel, on the refuel/defuel control panel the MODE SELECT switch is set to DEFUEL and the TRANSF.VALVE switch is set to OPEN.

NOTE: Note: When the MODE SELECT switch is set to DEFUEL, the high level protection of the FCMC is inhibited.

On the cockpit overhead FUEL panel:
- the X FEED valve P/BSW is set to ON,
- the STBY or MAIN engine fuel pumps are set to on,
- once the engine fuel pumps run, the FCMC opens the aft transfer valves,
- the FCMC will prevent any overbalance condition during the defueling.

NOTE: Note: The FCMC will prevent movement of fuel from the wing tanks (the aft transfer valve stay closed) until the trim tank is empty in order to prevent any overbalance condition.

Pushed by the pumps, the fuel will flow to the couplings through the refuel/defuel gallery. When the fuel quantity in one inner tank decreases to 3500 kg, the intertank transfer valves automatically open. The fuel in the outer tanks will be transferred by gravity to the inner tanks, and then pushed in the refuel/defuel gallery by the engine fuel pumps. The defueling process can be monitored on the ECAM FUEL page.

NOTE: Note: If the outer tanks are not to be defueled, both intertank transfer valves C/Bs (6QL1 & 6QL2) must be pulled.

At the end of the pressure defuel, the STBY and/or MAIN engine fuel pumps are set to OFF, the X FEED valve is closed. The FCMC closes both aft transfer valves. On the refuel/defuel panel, the TRANSF. VALVE switch is set to CLOSED and the MODE SELECT switch is set to OFF.

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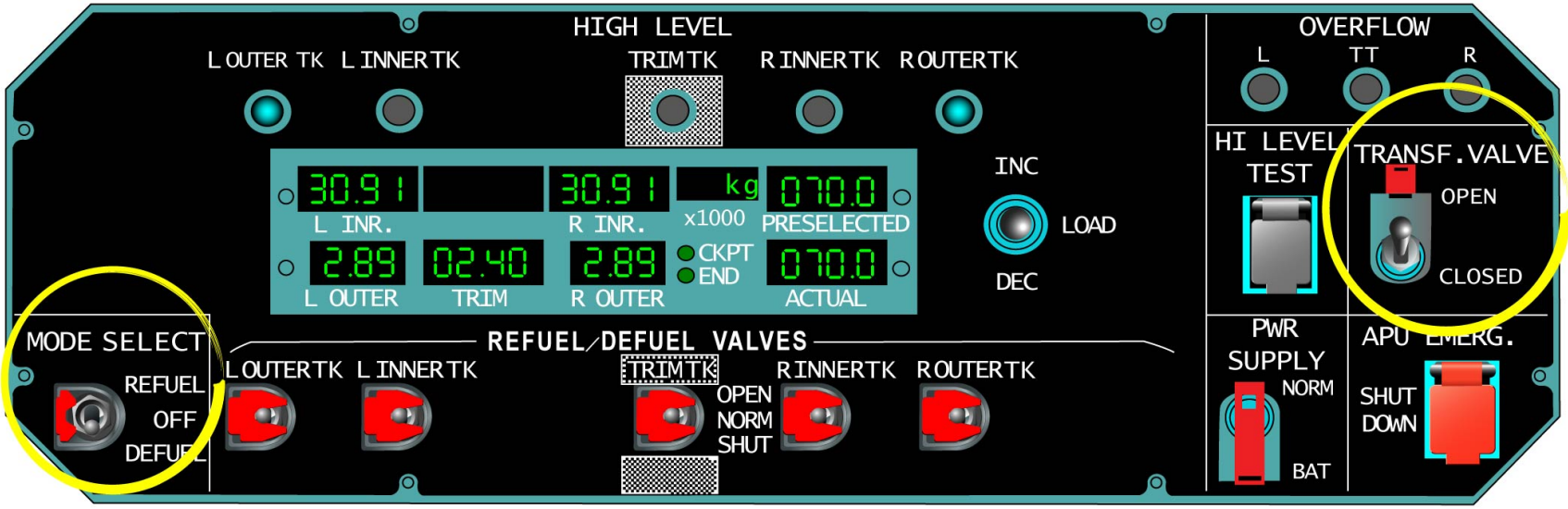
REFUEL/DEFUEL PANEL (990VU)



PRESSURE DEFUEL

OPERATION - PRESSURE DEFUEL OPERATION

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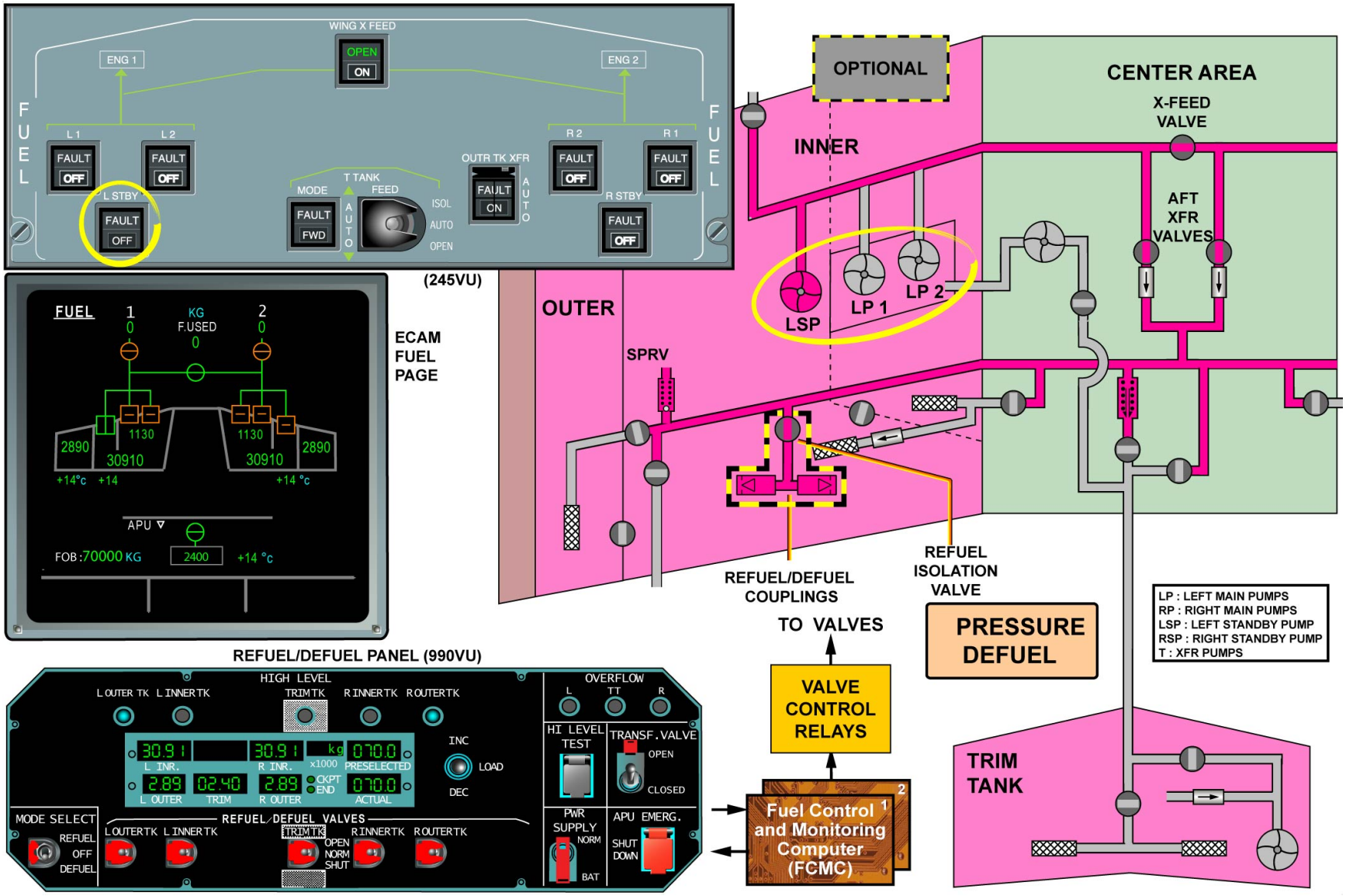

OPERATION - PRESSURE DEFUEL OPERATION

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REFUEL/DEFUEL D/O (A330-300)

OPERATION (continued)

SUCTION DEFUEL OPERATION

This procedure describes the defueling by suction of the wing tanks only. However it is possible to suction defuel all fuel tanks.

NOTE: Note: The wing tanks cannot be defueled until the trim tank is empty.

On the refuel/defuel panel the MODE SELECT switch is set to DEFUEL, and the necessary fuel tank inlet valves are set to OPEN.

NOTE: Note: One or two defuel hoses can be used to do a pressure defuel. But if only one coupling is used, it must be the one identified by the "USE THIS ADAPTOR TO DEFUEL" marking.

The FCMC controls the refuel/defuel isolation valve solenoids. As soon as the suction motor of the fuel tanker is running, the refuel/defuel isolation valve is open by the fuel suction. Each inlet valve selected OPEN on the refuel/defuel panel is controlled open by the FCMC. The suction defuel operation is monitored on the refuel/defuel panel. When completed, the REFUEL/DEFUEL VALVES switches are set back to NORM, and the MODE SELECT switch is set back to OFF.

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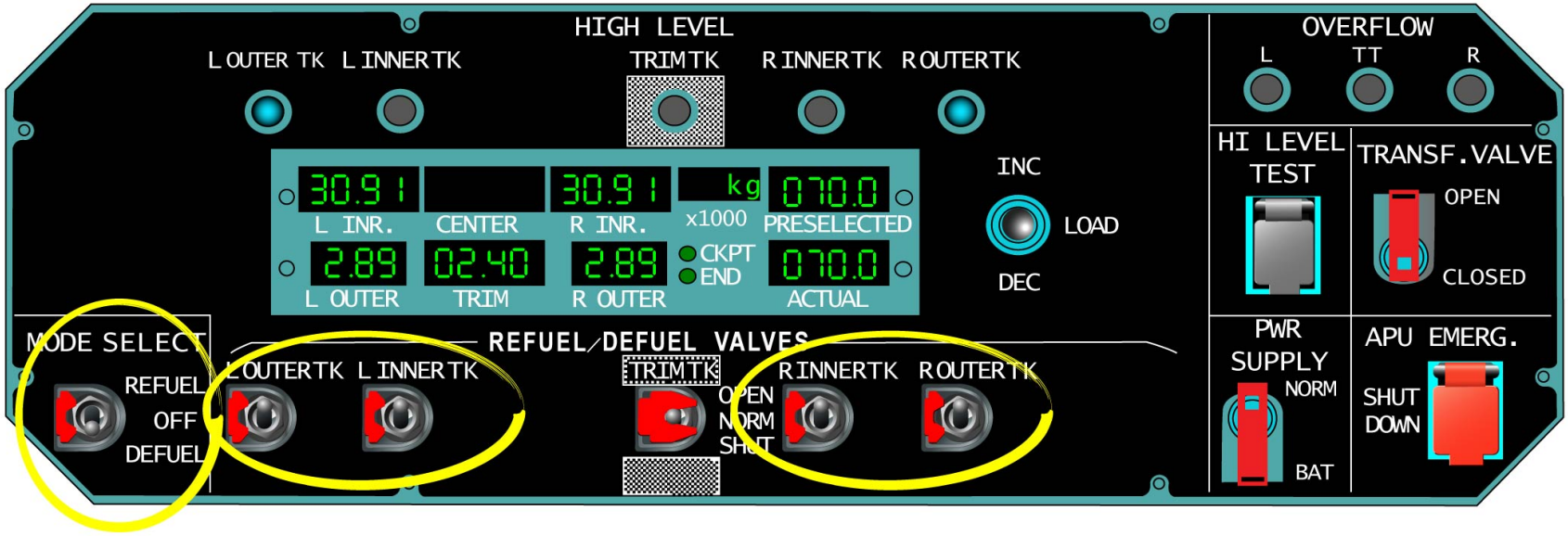
REFUEL/DEFUEL PANEL (990VU)



SUCTION DEFUEL

OPERATION - SUCTION DEFUEL OPERATION

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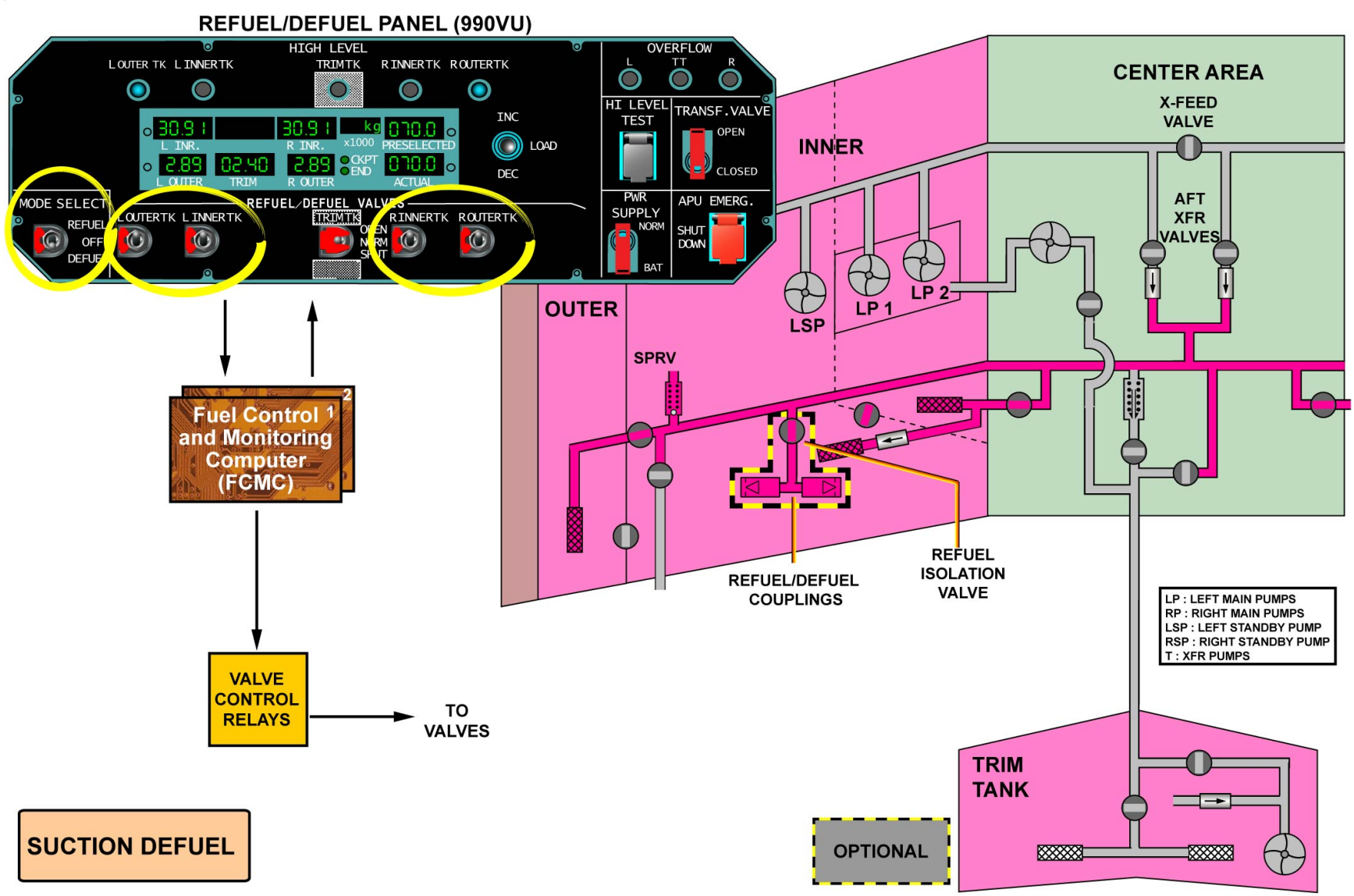

OPERATION - SUCTION DEFUEL OPERATION

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REFUEL/DEFUEL D/O (A330-300)

OPERATION (continued)

INNER TANKS GROUND TRANSFERS

The ground transfer from tank to tank can be initiated from the refuel/defuel panel except for a transfer to the trim tank. In this mode, the FCMC does not energize the refuel/defuel isolation valves and keeps the trim tank inlet valve closed. The FCMC hi-level protection is active. To initiate a ground transfer, actions from the cockpit and refuel/defuel panels are necessary. The following procedure describes a ground transfer between both wing inner tanks.
On the refuel/defuel panel:
- the REFUEL/DEFUEL VALVES switch for the tank to receive fuel is selected OPEN,
- the TRANSF. VALVE switch is set to OPEN,
- the MODE SELECT switch is set to REFUEL.

On the cockpit overhead FUEL panel:
- the X FEED valve P/BSW is set to ON,
- the STBY engine pump of the "supplier" inner tank is set to on,
- once the engine pump runs, the FCMC opens the aft transfer valves,
- the fuel is thus pushed from the "supplier" inner tank through the crossfeed valve, both aft transfer valves and finally through the inlet valve of the "receiver" inner tank.

The inner tanks ground transfer is monitored from the ECAM FUEL page. When the inner tanks fuel quantity is at the required value, the engine STBY pump of the "supplier" tank is selected OFF and the X FEED valve P/BSW is selected OFF. On the refuel/defuel panel, the MODE SELECT switch is set to OFF, the REFUEL/DEFUEL VALVES switch of the "receiver" tank is set to NORM and the TRANSF. VALVE switch is set to CLOSED.

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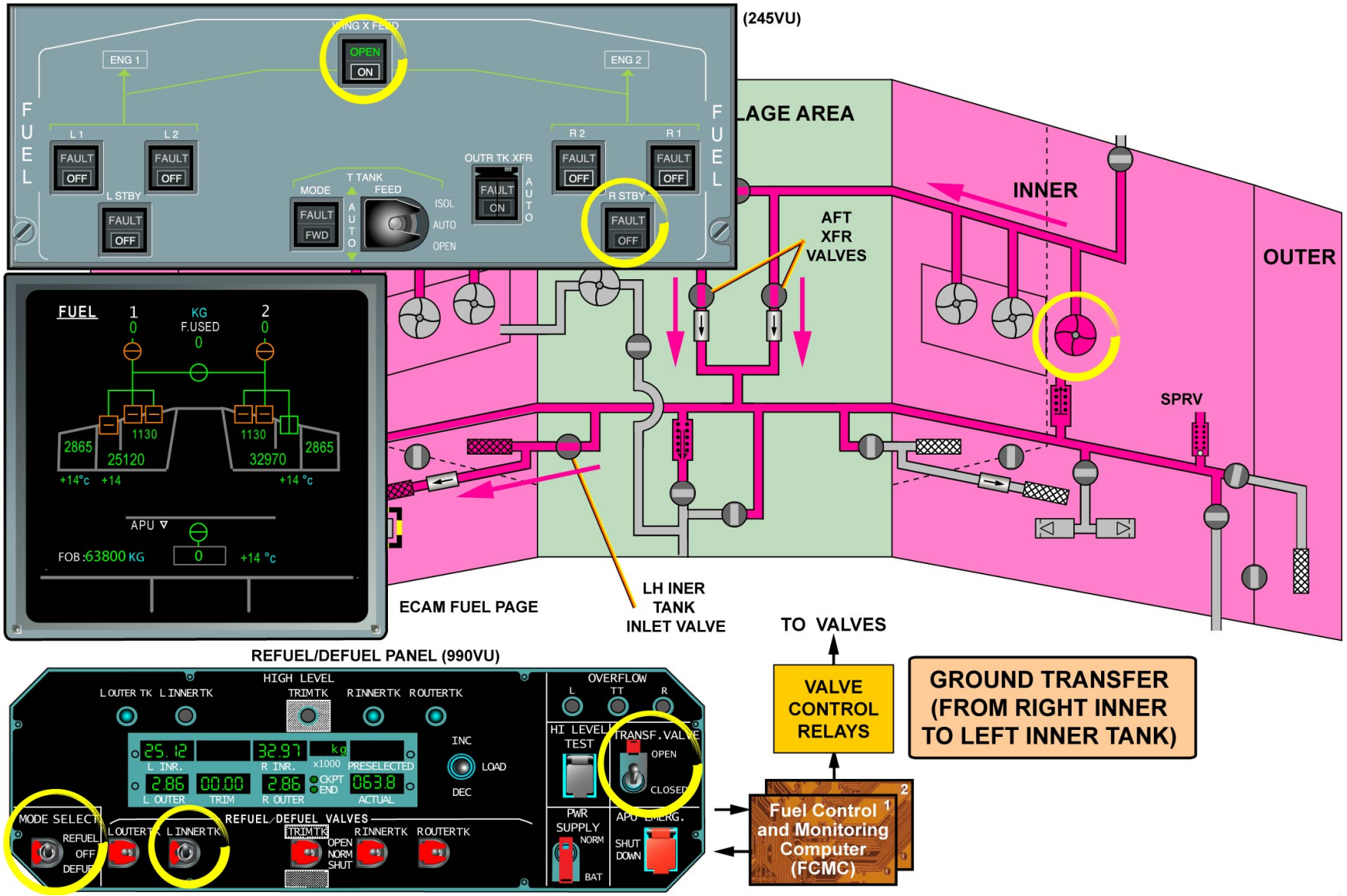

OPERATION - INNER TANKS GROUND TRANSFERS

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JETTISON D/O (A330-200)

GENERAL

The jettison system makes it possible to dump some of the A/C fuel in flight. The output rate is approximately 1080 kg (2382 lb) per minute. The system is activated from the JETTISON panel on the cockpit overhead panel. It can be manually stopped by the crew or automatically by the Fuel Control and Monitoring Computers (FCMCs).

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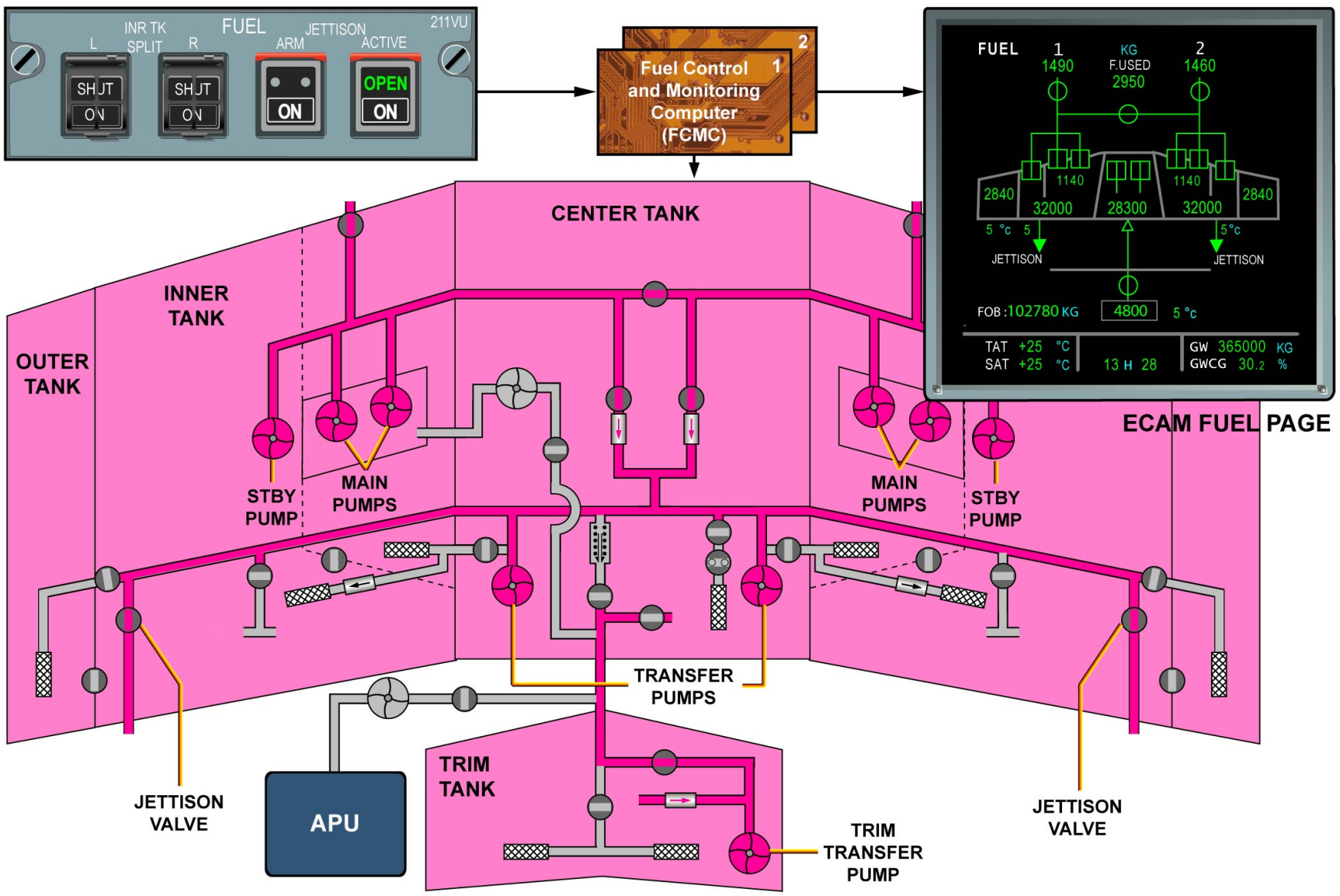

GENERAL

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JETTISON D/O (A330-200)

DESCRIPTION

Here is a detailed description of the jettison system.

JETTISON VALVE AND ACTUATOR

In each inner tank, a jettison valve is installed in a fuel line from the refuel gallery, and is attached to the bottom skin between rib 17 and rib 18.

The valve is of the ball type and controls the flow of fuel from the refuel gallery to the jettison pipe. It is driven by a dual electrical motor actuator powered by the 28 VDC BUS. The actuator has a visual indicator.

JETTISON PIPE AND OUTLET

The jettison pipe goes from the jettison valve, through the No. 4 flap track fairing, to a position behind the flap track fairing. The jettison pipe outlet is installed outboard of the engine, so that fuel is ejected clear of A/C fuselage and the tail plane. An anti-corona discharge assembly is installed at the outlet of the jettison pipe. This assembly is made from a material that has no metal in it. Thus all electrical discharge effects occur in the metal part of the pipe. But the fuel comes out safely downstream through the composite part of the pipe.

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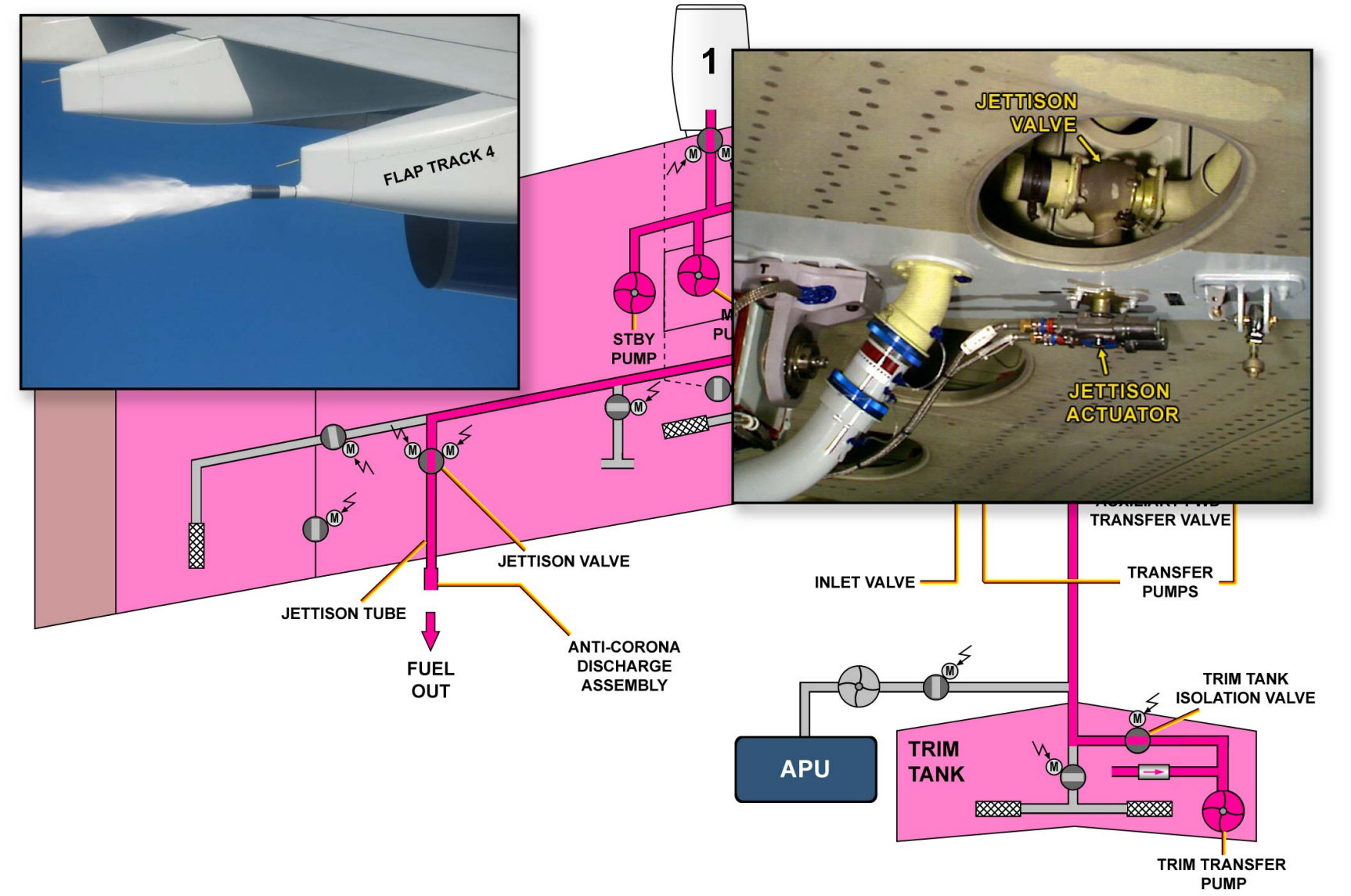

DESCRIPTION - JETTISON VALVE AND ACTUATOR & JETTISON PIPE AND OUTLET

JETTISON D/O (A330-200)

OPERATION

Let's see the normal and abnormal operations of the jettison system in detail.

NORMAL OPERATION

On the FUEL control panel, when the two jettison P/Bs are set to ON:
- the white ON lights come on on the P/Bs,
- the FCMCs connect a 28 VDC supply to the actuators which operate, and the jettison valves open,
- if there is fuel in the center tank, the two transfer pumps supply the fuel from the center tank,
- the trim pipe isolation valve and all the fuel tank inlet valves (except for the trim tank) close,
- the two aft transfer valves open,
- all the main and stand-by pumps supply fuel from the inner tanks,
- the crossfeed valve opens,
- if there is fuel in the trim tank, a FWD transfer starts into the center tank. The fuel, from the inner, center and trim tanks then flows through the jettison valves and from the jettison pipe in the No 4 flap track fairing overboard.

The operation of the jettison system goes on until one of these conditions occurs:
- the crew manually stops the operation by releasing out either any of the JETTISON ARM or JETTISON ACTIVE P/B,
- the A/C gross weight decreases to a pre-set jettison final gross weight entered by the crew on the MCDU in the FUEL PREDiction page,
- the total fuel quantity in the inner tanks is less than 10000 kg (22000 lb),
- both inner tanks ETOPS warning sensors are dry.

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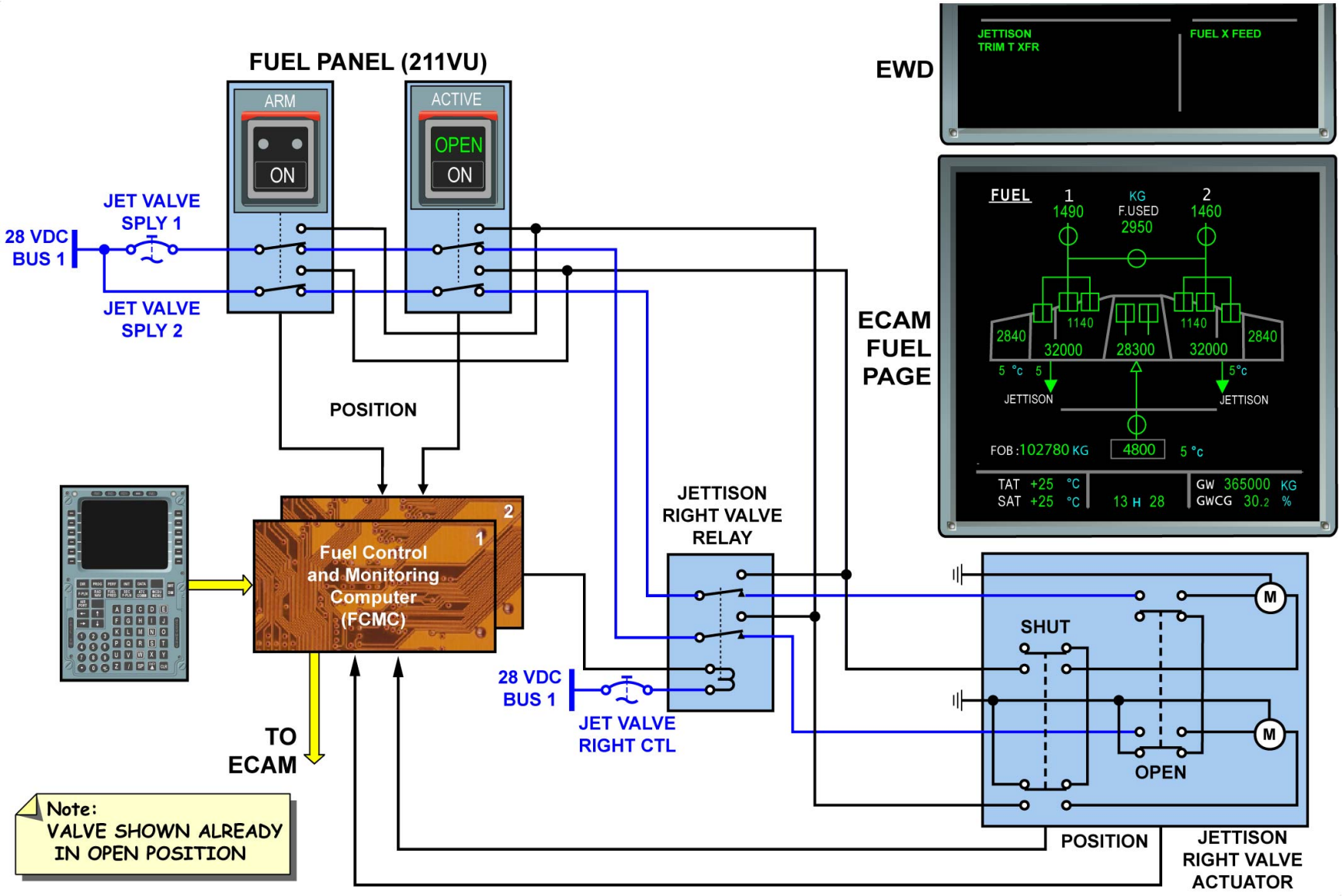

OPERATION - NORMAL OPERATION

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JETTISON D/O (A330-200)

OPERATION (continued)

ABNORMAL OPERATION

When jettison operation is selected and one of the jettison valves is not open, a JETTISON FAULT warning is triggered on the ECAM.
When the system is not ON and one of the jettison valves is not closed, a JETTISON NOT CLOSED warning is triggered on the ECAM.

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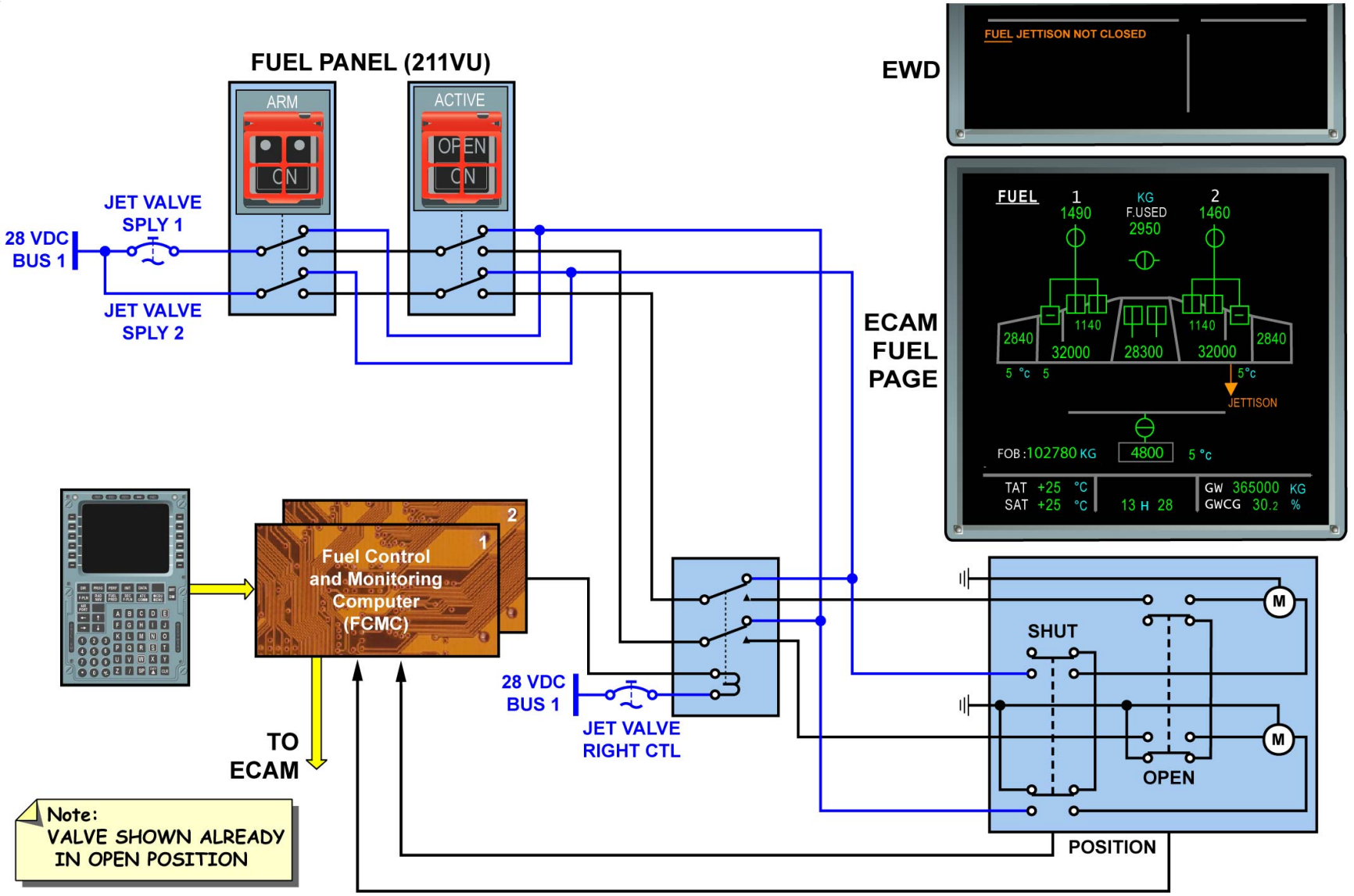

OPERATION - ABNORMAL OPERATION

FUEL TANK SAFETY PROCEDURES (2)

General

Following three fuel tank explosions over the past 14 years which resulted in 346 fatalities, the U.S Department of Transportation's Federal Aviation Administration (FAA), have introduced new regulations to improve fuel tank safety.
These regulations relate to the prevention of ignition sources within fuel tanks of current type certificated aircraft. They require carrying out a one-time fuel system safety and design review.

Critical Design Configuration Control Limitations (CDCCL)

The FAA issued Special Federal Aviation Regulation (SFAR) 88 which gives a detailed description of the CDCCL concept.
The DGAC requested the SFAR 88 to be added to PART 145, PART M and PART 147 to reinforce the application of these regulations.
This includes:
- a conception part intended to aircraft design features,
- a maintenance part.

A CDCCL is a limitation requirement to preserve a critical ignition source prevention feature of the fuel system design that is necessary to prevent the occurrence of an unsafe condition.
The function of the CDCCL is to give instructions to retain the critical ignition source prevention feature during configuration change that may be caused by alterations, repairs or maintenance actions.
The aircraft manufacturers have to emit a document to their customers giving the list of all the maintenance tasks impacted by the CDCCL.
For AIRBUS this document is called the Fuel Airworthiness Limitations and it is added to the Airworthiness Limitation Section part 5.

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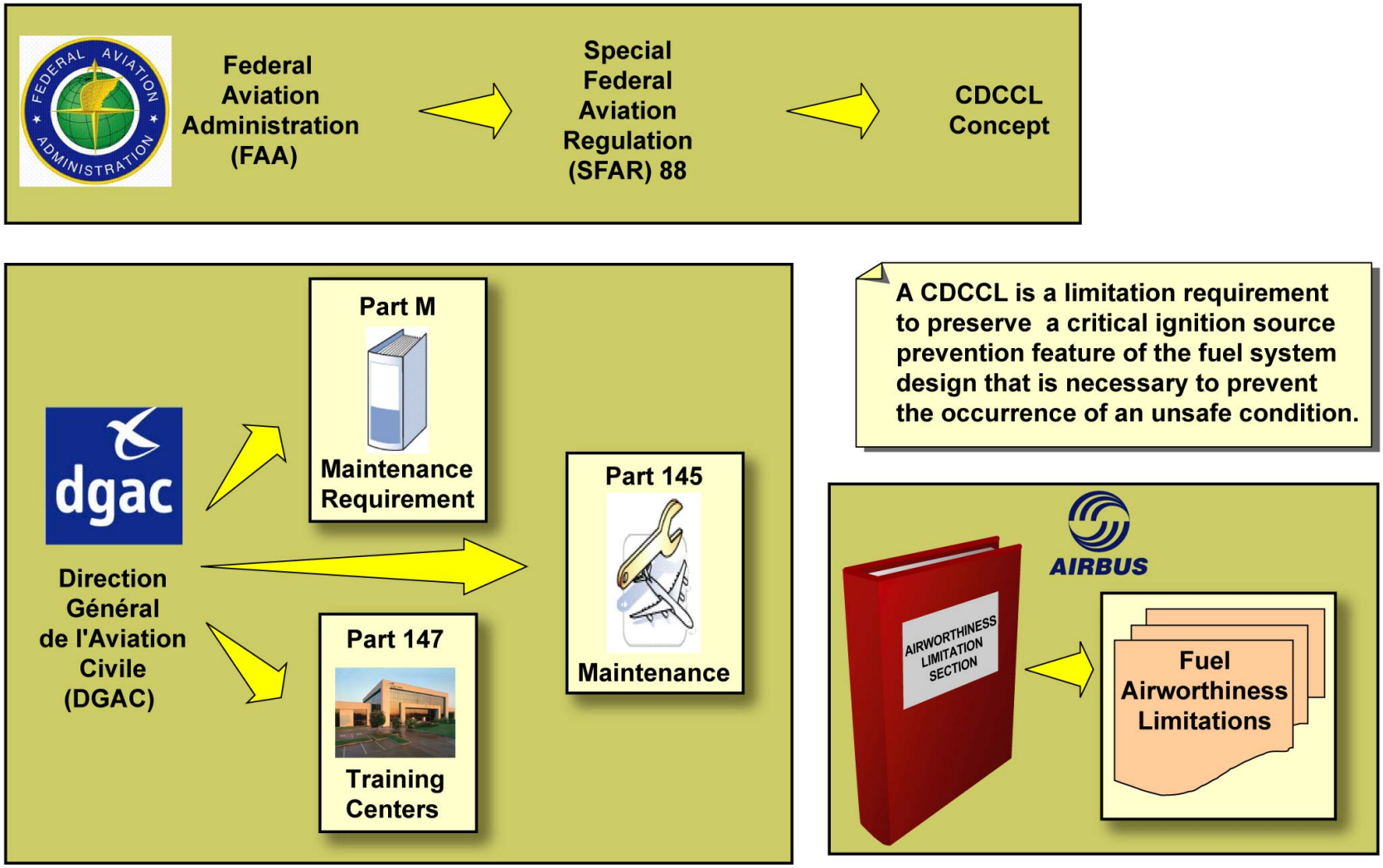
CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL)


Federal Aviation Administration (FAA)
Special Federal Aviation Regulation (SFAR) 88
CDCCL Concept
Part M
Maintenance Requirement
dgac
Direction Général de l'Aviation Civile (DGAC)
Part 145
Maintenance
Part 147
Training Centers
A CDCCL is a limitation requirement to preserve a critical ignition source prevention feature of the fuel system design that is necessary to prevent the occurrence of an unsafe condition.
AIRBUS
AIRWORTHINESS LIMITATION SECTION
Fuel Airworthiness Limitations

GENERAL - CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL)

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FUEL TANK SAFETY PROCEDURES (2)

General (continued)

Fuel Information and Combustion Triangle

A fuel tank can be viewed as a confined space where under specific conditions of pressure and temperature the ullage (vacant tank space) can be made of an evaporated fuel/air mixture known as fuel vapor.
The liquid fuel does not blow up on its own; explosive conditions are created when specific proportions of evaporated fuel, oxygen, pressure and temperature are present in the tank ullage; the fuel vapor is then defined as flammable. Even if the ullage is flammable, an explosion will not occur unless an ignition source of sufficient energy exists.
The combustion triangle:
An Explosion in a "Fuel" environment such as aircraft wing tanks can only occur if the 3 following sources are reached:
- fuel vapors,
- air (Oxygen O2),
- ignition (Electrical short cut, cigarette, etc.).

The aircraft fuel system has, by design, a number of features that are intended to protect the system from inadvertent ignition.
The potential sources of ignition considered are:
- spark generation inside a fuel tank by electrical current originated from external sources such as a lightning strike on the aircraft, by wiring or equipment electrical faults,
- spark/heat generation inside a fuel tank caused by friction of moving parts,
- fuel leakage outside of a fuel tank coming into contact with an ignition source.

A chart shows the fuel grades used.
The flash point is the lowest temperature at which the liquid supplies enough vapors mixed with ambient air, to make a gas that will ignite with the contact of a thermal source, also called flame.
At this temperature the combustion will not be self sufficient, because you need to reach the ignition point.
If the ignition does not need a flame, we talk about auto-ignition.
The Auto-Ignition point is the temperature at which a gas or a vapor ignites spontaneously in the absence of a thermal source.
Do not confuse this term with the ignition point (temperature at which the combustion is started and can continue).

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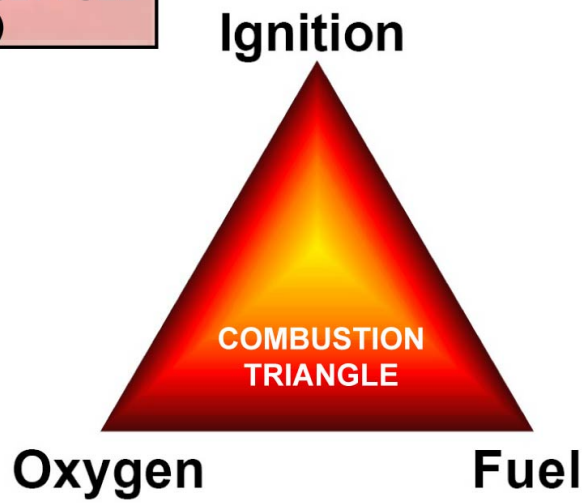
COUNTRY	ORGANISATION	GRADE DESIGNATION
—	IATA	KEROSENE
US	ASTM DOD	JET A, JET A1 JP 8 JP 5
UK	MOD	AVTUR AVCAT TS - 1, RT
CHINA	PRC MPIS	No. 3 JET FUEL (RP 3)

JET A CARACTERISTICS	
Color	Colorless to yellow
Freeze temperature	< - 47°C
Density	From 0,775 to 0,840
Flash point	Minimum 38°C at sea level 7°C at 12000 m
Self ignition temperature	>230°C

Flash point :
The flash point is the lowest temperature at which the liquid supplies enough vapors mixed with ambient air, to make a gas that will ignite with the contact of a thermal source (flame).



Auto-Ignition point :
the temperature at which a gas or a vapor ignites spontaneously in the absence of a thermal source.

GENERAL - FUEL INFORMATION AND COMBUSTION TRIANGLE

G9409341 - GAUT0T0 - XM28D1000000001

FUEL TANK SAFETY PROCEDURES (2)

Fuel System Design Configuration

The Airbus aircraft fuel systems have, by design, a number of features that are intended to protect the system from inadvertent ignition.

- Wing / Trim Tank Structure:

In all the fuel tanks, the material and the large number of fasteners on the attachment of the metallic structure used make sure that the fuel tank structures are electrically bonded.

Composite ribs are bonded by means of metallic strips attached to the non-metallic structure.

All aluminum structural items in the wing, trim and centre boxes have a finishing for protection against electrical harnesses short-circuit with the structure.

The combination of the construction and thickness of the tank boundary skins give protection against a lightning strike causing ignition (heat).

- Fuel Quantity Indicating (FQI) Equipment:

Probes and sensors installed in tanks have low power supply. Electrical connection is done through a terminal block. The protective gap between the probes and the tank structure is maintained. They are electrically isolated from the structure.

- Fuel pump:

Fuel pumps have safety features to prevent pumps from working in an empty fuel tank. The pumps are tested to show that even after a long working condition in an "empty fuel tank" the rotating surfaces remain lubricated and thus limit the risk of mechanical ignition.

Each of the pumps is contained within an explosion-proof canister. It comprises a pump element contained within and electrically bonded to the canister and driven by an electric motor. Electrical connections to all pumps are made outside the tank.

The moving parts inside the pump are normally submerged in fuel so they cannot generate a spark during faulty conditions.

- Lightning Protection:

All equipment installed within any fuel tank is bonded to the structure

- Fuel System Wiring:

Only when absolutely necessary, wiring is routed inside fuel tanks. This wiring is limited to sensing and monitoring systems, with very low energy carrying requirements, to protect against the occurrence of an ignition source as a result of high energy entering the fuel tank via the wiring.

External electrical wiring support clamps make sure, that a cut cable cannot come into contact with the fuel tank boundary or structure in a fuel vapor area.

There is a complete segregation between in-tank wiring equipment and fuel calculators from other aircraft system wirings.

- Valves:

All motor operated valves within the fuel tanks have the actuator located outside the tank wall. The valve mechanisms inside the tank are dual bonded and do not have an ignition hazard.

- Pressure Switches:

Pump pressure switches are mounted on the tank boundaries. They are separated from the fuel by a diaphragm. The electrical connections are fully sealed and explosion proof.

- Fuel Leaks:

It is possible for fuel or fuel vapor to leak from a fuel tank into an adjacent area and the accumulated fuel can become hazardous causing ignition.

Fuel leaks from the wing and trim tanks go either to the leading or trailing edge cavities or to the outside. Any fuel overflowing from the NACA intake is directed downwards and away from the engines (heat source) via a fuel leak drip strip (angle section) located inboard of the NACA intake. In the leading and trailing edges the equipment is explosion proofed and insulated from the leakage. The APU fuel feed and Trim Tank transfer pipes at the rear fuselage are shrouded so any fuel leakage is drained overboard via the drain mast.

- Heat Sources:

Wing leading edges contain hot air ducting from the engines to the bleed air and anti icing systems. These pipes are insulated and separated from the tank boundary.

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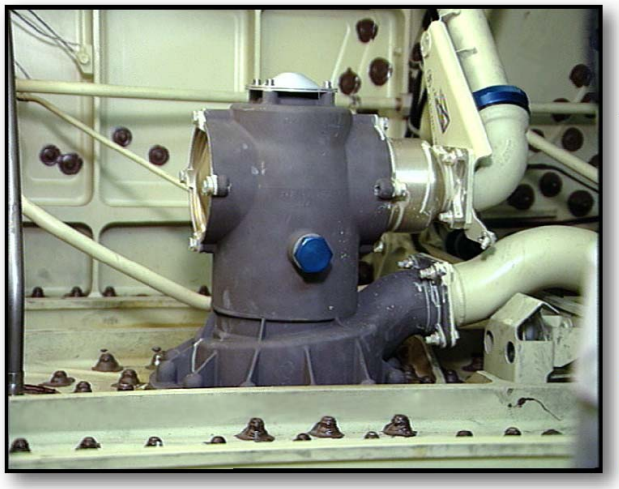
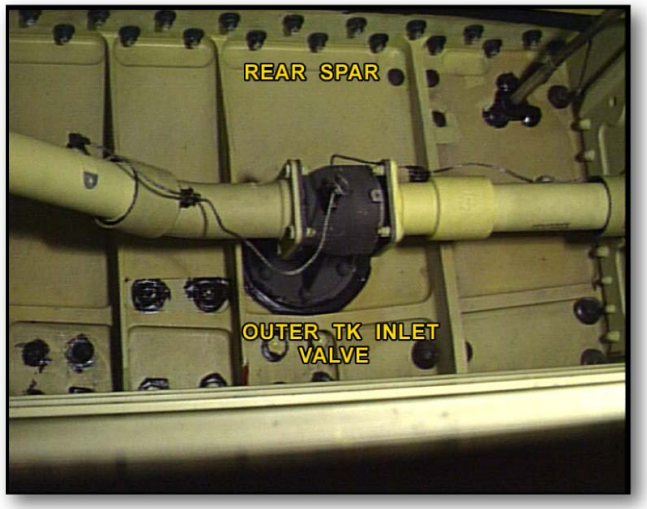
Electrical harnesses in the tanks use very low voltage current (less than 5 VDC) and are far enough for the surrounding equipment and structure (segregated routing).

Fuel pumps are the only electrical equipment using high power current (115 VAC). Consequently, pumps harnesses are located under the lower wing skin panels outside the fuel tanks.



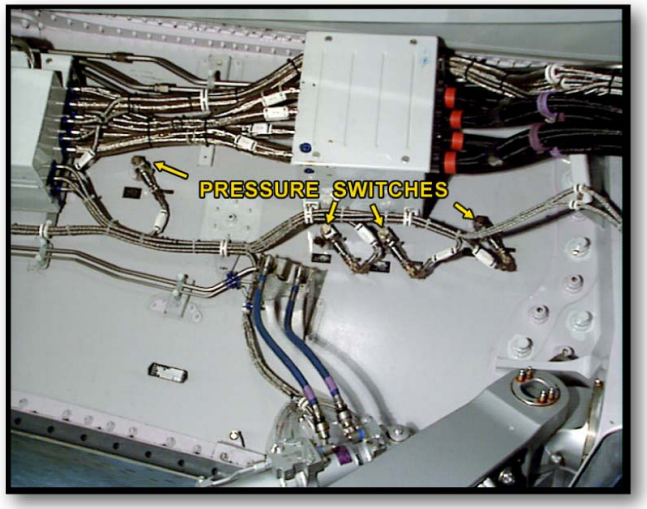
Fuel pumps are installed in a self-contained explosive canister.

FUEL SYSTEM DESIGN CONFIGURATION



Bonded valve inside the tank

Insulated hot air duct and Valve actuator located ouside of the tank



Pressure Switches and FQI terminal block

Wing fence and Naca air intake

FUEL SYSTEM DESIGN CONFIGURATION

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FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL

CDCCL items are listed in Airworthiness Limitation Form.
CDCCL section 2 of Airworthiness Limitation Form.

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AIRBUS

Customer Services Directorate

A330 Fuel Airworthiness Limitations

SECTION 0 - INTRODUCTION

1. SCOPE

This document contains the Fuel Airworthiness Limitations that arise from compliance with JAA's Interim Policy on Fuel Tank Safety (INT/POL/25/12) and FAA's Special Federal Aviation Regulation (SFAR) 88. They have been derived in accordance with JAA's draft Temporary Guidance Leaflet (TGL) 47 and FAA's Advisory Circular (AC) 25.981-1B. The nomenclature and means of promulgation follow the FAA's memorandum ref PS-ANM100-2004-10029 'Policy Statement on Process for Developing SFAR 88-related Instructions for Maintenance and Inspection of Fuel Tank Systems'. This latter document has been jointly developed between FAA and JAA to ensure a unified approach.

These requirements, together with the Life Limits / Monitored Parts, structural Airworthiness Limitation Items (ALI) and systems Certification Maintenance Requirements (CMR) comprise the Airworthiness Limitation Section which satisfies the requirements of JAR 25.1529 Appendix H paragraph 25.4.

IMPORTANT: At first delivery of an aircraft configuration into an operator's fleet, the requirements given in this document are mandatory, except in so far that interval escalations can be justified in accordance with the procedure stated herein. If a more restrictive Fuel ALI is issued on an aircraft configuration already in service, the requirement for existing operators to follow the revised FAL document will normally be mandated by Airworthiness Directive (Consigne de Navigabilité).

Non-compliance suspends the validity of the Airworthiness Certificate.

The identification of Fuel Airworthiness Limitations in no way diminishes the importance of other tasks and practices associated with the fuel system. Changes to these are subject to normal practices and procedures between the operator and his national authorities.

This document does not take into account Airworthiness Directives (Consigne de Navigabilité) which, if issued against an existing Fuel Airworthiness Limitation, supersede the specific requirement given in this document

MAINTENANCE APPLICATION OF CDCCL

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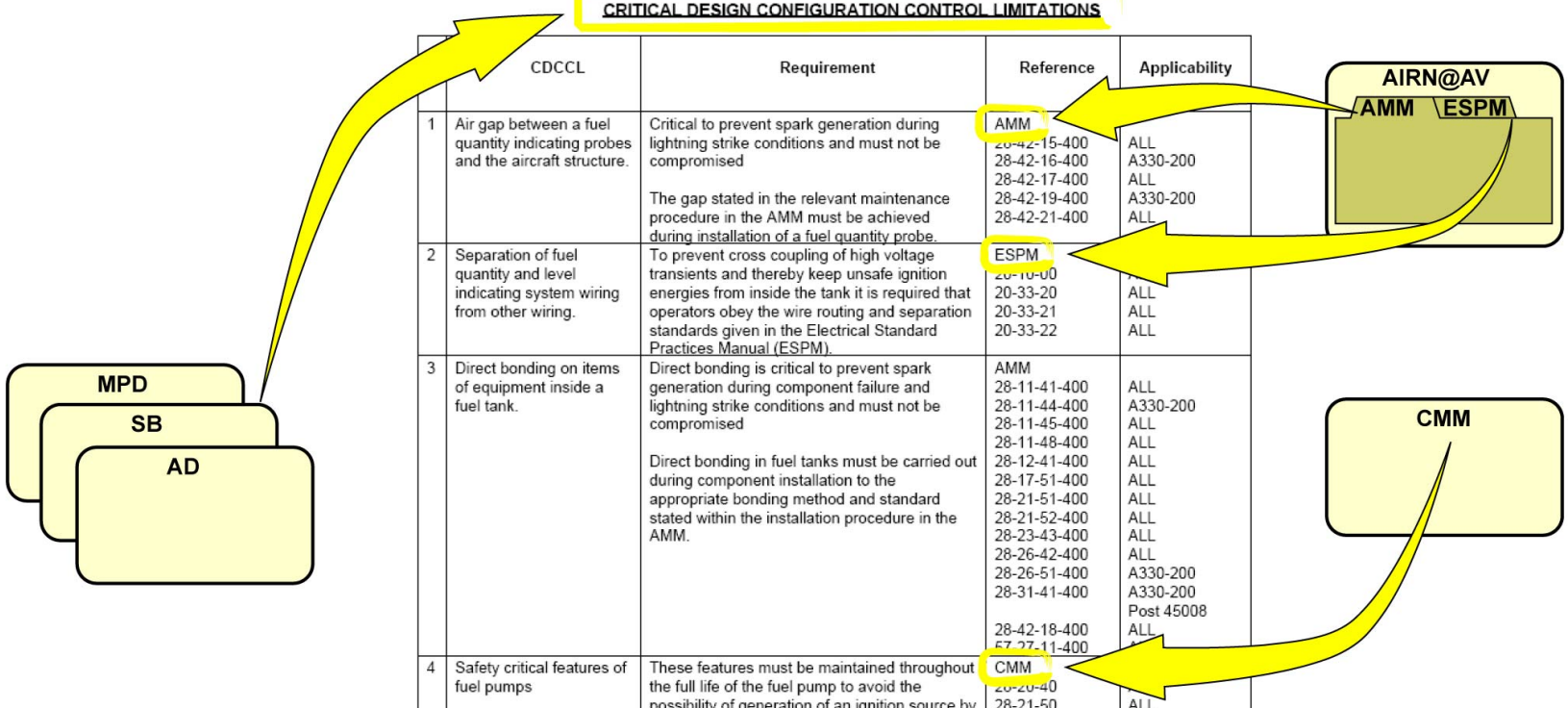
AIRBUS
Customer Services Directorate

A330 Fuel Airworthiness Limitations

SECTION 2

CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS

	CDCCL	Requirement	Reference	Applicability
1	Air gap between a fuel quantity indicating probes and the aircraft structure.	Critical to prevent spark generation during lightning strike conditions and must not be compromised The gap stated in the relevant maintenance procedure in the AMM must be achieved during installation of a fuel quantity probe.	AMM 28-42-15-400 28-42-16-400 28-42-17-400 28-42-19-400 28-42-21-400	 ALL A330-200 ALL A330-200 ALL
2	Separation of fuel quantity and level indicating system wiring from other wiring.	To prevent cross coupling of high voltage transients and thereby keep unsafe ignition energies from inside the tank it is required that operators obey the wire routing and separation standards given in the Electrical Standard Practices Manual (ESPM).	ESPM 20-33-20 20-33-21 20-33-22	 ALL ALL ALL
3	Direct bonding on items of equipment inside a fuel tank.	Direct bonding is critical to prevent spark generation during component failure and lightning strike conditions and must not be compromised Direct bonding in fuel tanks must be carried out during component installation to the appropriate bonding method and standard stated within the installation procedure in the AMM.	AMM 28-11-41-400 28-11-44-400 28-11-45-400 28-11-48-400 28-12-41-400 28-17-51-400 28-21-51-400 28-21-52-400 28-23-43-400 28-26-42-400 28-26-51-400 28-31-41-400 28-42-18-400	 ALL A330-200 ALL ALL ALL ALL ALL ALL ALL ALL A330-200 A330-200 Post 45008 ALL
4	Safety critical features of fuel pumps	These features must be maintained throughout the full life of the fuel pump to avoid the possibility of generation of an ignition source by overheating or sparks caused by arcing, friction etc. Repair and overhaul of fuel pumps must be carried out in accordance with the equipment manufacturer's maintenance instructions or other maintenance instructions acceptable to the certifying authority.	CMM 28-21-50	 ALL



MAINTENANCE APPLICATION OF CDCCL

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FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL (continued)

AMM Application

A WARNING in the procedures identifies CDCCL items. When a procedure identifies a CDCCL item, it is mandatory and necessary that you follow the instructions correctly and accurately.
Air gap between fuel quantity indicating probes and the aircraft structure.

WARNING: THIS PROCEDURE USES A FUEL SYSTEM ITEM THAT IS IN A CATEGORY KNOWN AS A CRITICAL DESIGN CONFIGURATION CONTROL LIMITATION (CDCCL). CDCCL IDENTIFIES AN ITEM THAT CAN BE THE SOURCE OF A POSSIBLE FUEL TANK IGNITION. YOU MUST KEEP ALL CDCCL ITEMS IN THE APPROVED CONFIGURATION. DAMAGE, WEAR OR CHANGES TO A CDCCL ITEM CAN CAUSE A POSSIBLE FUEL TANK EXPLOSION.

WARNING: THIS INSTRUCTION IS APPLICABLE TO A CRITICAL DESIGN CONFIGURATION CONTROL LIMITATION (CDCCL). CAREFULLY OBEY ALL GIVEN INSTRUCTIONS WHEN YOU DO THIS STEP. IF YOU DO NOT OBEY THESE INSTRUCTIONS, A DANGEROUS CONDITION CAN OCCUR THAT CAN CAUSE A POSSIBLE FUEL TANK EXPLOSION.

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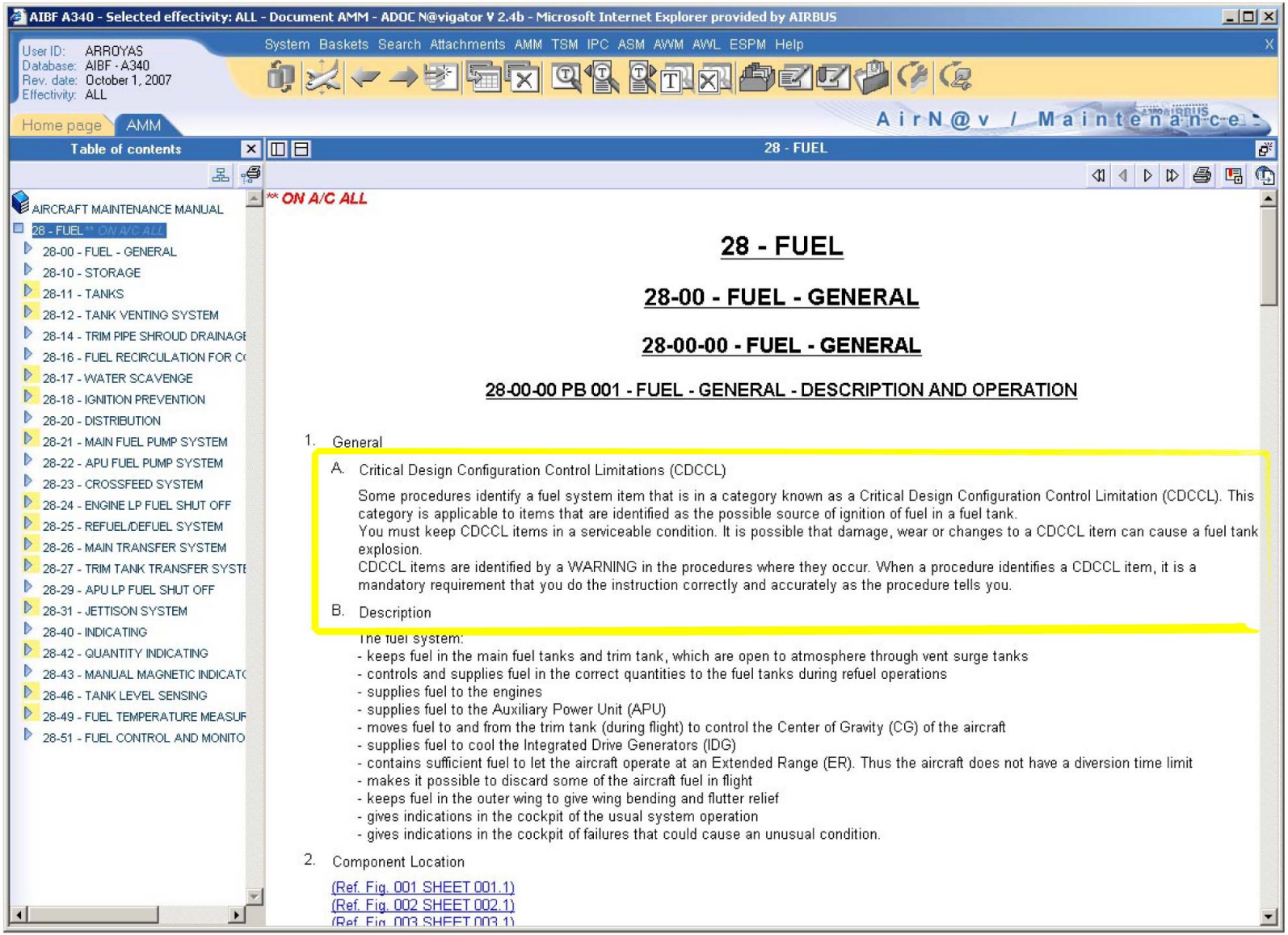
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User ID: ARROYAS
Database: AIBF - A340
Rev. date: October 1, 2007
Effectivity: ALL
Home page
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** ON A/C ALL
28 - FUEL
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28-00-00 PB 001 - FUEL - GENERAL - DESCRIPTION AND OPERATION
1. General
A. Critical Design Configuration Control Limitations (CDCCL)
Some procedures identify a fuel system item that is in a category known as a Critical Design Configuration Control Limitation (CDCCL). This category is applicable to items that are identified as the possible source of ignition of fuel in a fuel tank.
You must keep CDCCL items in a serviceable condition. It is possible that damage, wear or changes to a CDCCL item can cause a fuel tank explosion.
CDCCL items are identified by a WARNING in the procedures where they occur. When a procedure identifies a CDCCL item, it is a mandatory requirement that you do the instruction correctly and accurately as the procedure tells you.
B. Description
The fuel system:
- keeps fuel in the main fuel tanks and trim tank, which are open to atmosphere through vent surge tanks
- controls and supplies fuel in the correct quantities to the fuel tanks during refuel operations
- supplies fuel to the engines
- supplies fuel to the Auxiliary Power Unit (APU)
- moves fuel to and from the trim tank (during flight) to control the Center of Gravity (CG) of the aircraft
- supplies fuel to cool the Integrated Drive Generators (IDG)
- contains sufficient fuel to let the aircraft operate at an Extended Range (ER). Thus the aircraft does not have a diversion time limit
- makes it possible to discard some of the aircraft fuel in flight
- keeps fuel in the outer wing to give wing bending and flutter relief
- gives indications in the cockpit of the usual system operation
- gives indications in the cockpit of failures that could cause an unusual condition.
2. Component Location
(Ref. Fig. 001 SHEET 001.1)
(Ref. Fig. 002 SHEET 002.1)
(Ref. Fig. 003 SHEET 003.1)

MAINTENANCE APPLICATION OF CDCCL - AMM APPLICATION

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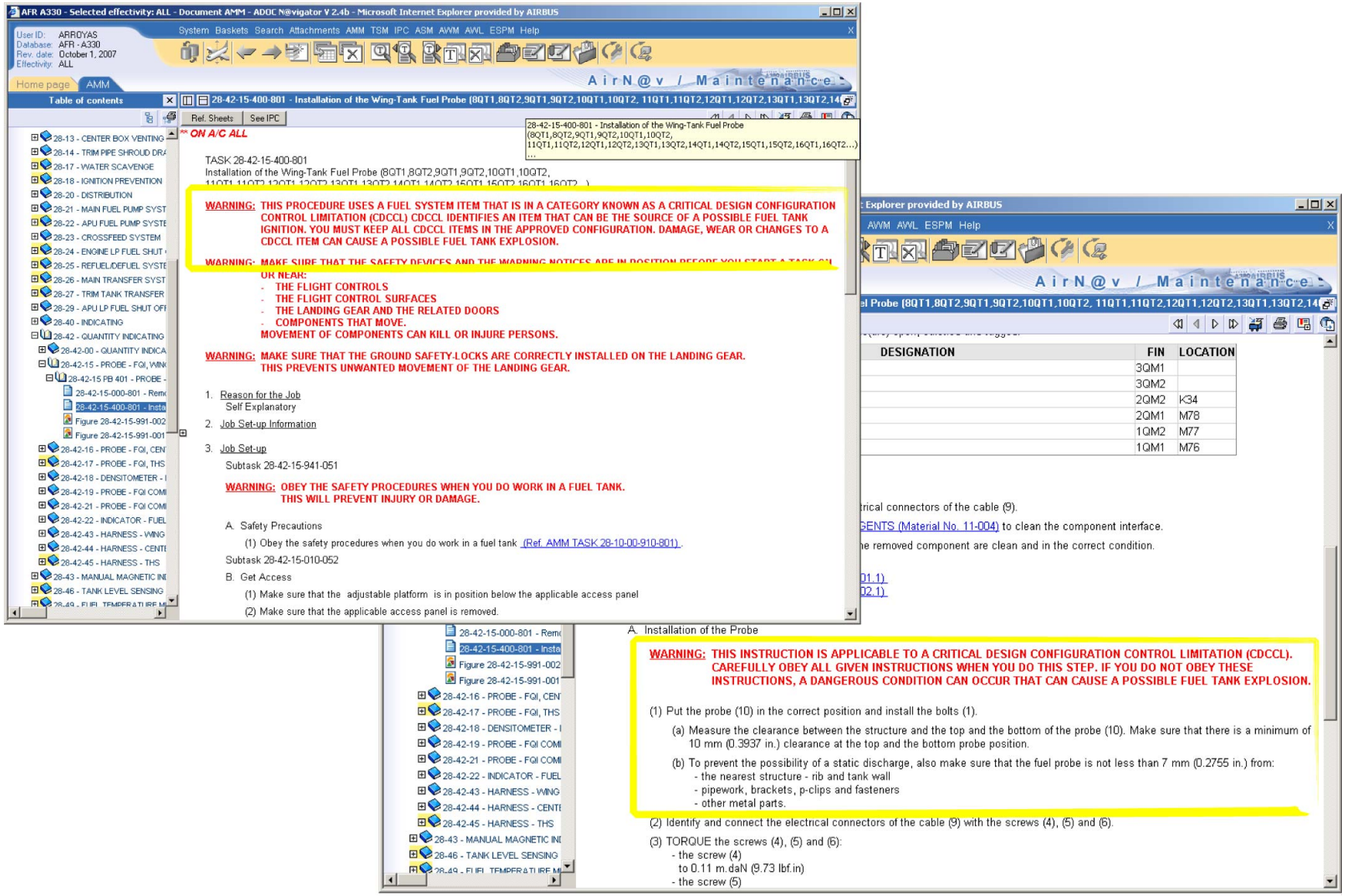
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28-42-15-400-801 - Installation of the Wing-Tank Fuel Probe
** ON A/C ALL
TASK 28-42-15-400-801
Installation of the Wing-Tank Fuel Probe (8QT1,8QT2,9QT1,9QT2,10QT1,10QT2,
WARNING: THIS PROCEDURE USES A FUEL SYSTEM ITEM THAT IS IN A CATEGORY KNOWN AS A CRITICAL DESIGN CONFIGURATION CONTROL LIMITATION (CDCCL) CDCCL IDENTIFIES AN ITEM THAT CAN BE THE SOURCE OF A POSSIBLE FUEL TANK IGNITION. YOU MUST KEEP ALL CDCCL ITEMS IN THE APPROVED CONFIGURATION. DAMAGE, WEAR OR CHANGES TO A CDCCL ITEM CAN CAUSE A POSSIBLE FUEL TANK EXPLOSION.
WARNING: MAKE SURE THAT THE SAFETY DEVICES AND THE WARNING NOTICES ARE IN POSITION BEFORE YOU START A TASK ON OR NEAR:
- THE FLIGHT CONTROLS
- THE FLIGHT CONTROL SURFACES
- THE LANDING GEAR AND THE RELATED DOORS
- COMPONENTS THAT MOVE.
MOVEMENT OF COMPONENTS CAN KILL OR INJURE PERSONS.
WARNING: MAKE SURE THAT THE GROUND SAFETY-LOCKS ARE CORRECTLY INSTALLED ON THE LANDING GEAR. THIS PREVENTS UNWANTED MOVEMENT OF THE LANDING GEAR.
1. Reason for the Job
Self Explanatory
2. Job Set-up Information
3. Job Set-up
Subtask 28-42-15-941-051
WARNING: OBEY THE SAFETY PROCEDURES WHEN YOU DO WORK IN A FUEL TANK. THIS WILL PREVENT INJURY OR DAMAGE.
A. Safety Precautions
(1) Obey the safety procedures when you do work in a fuel tank (Ref. AMM TASK 28-10-00-910-801).
Subtask 28-42-15-010-052
B. Get Access
(1) Make sure that the adjustable platform is in position below the applicable access panel
(2) Make sure that the applicable access panel is removed.
DESIGNATION
FIN
LOCATION
3QM1
3QM2
2QM2 K34
2QM1 M78
1QM2 M77
1QM1 M76
A. Installation of the Probe
WARNING: THIS INSTRUCTION IS APPLICABLE TO A CRITICAL DESIGN CONFIGURATION CONTROL LIMITATION (CDCCL). CAREFULLY OBEY ALL GIVEN INSTRUCTIONS WHEN YOU DO THIS STEP. IF YOU DO NOT OBEY THESE INSTRUCTIONS, A DANGEROUS CONDITION CAN OCCUR THAT CAN CAUSE A POSSIBLE FUEL TANK EXPLOSION.
(1) Put the probe (10) in the correct position and install the bolts (1).
(a) Measure the clearance between the structure and the top and the bottom of the probe (10). Make sure that there is a minimum of 10 mm (0.3937 in.) clearance at the top and the bottom probe position.
(b) To prevent the possibility of a static discharge, also make sure that the fuel probe is not less than 7 mm (0.2755 in.) from:
- the nearest structure - rib and tank wall
- pipework, brackets, p-clips and fasteners
- other metal parts.
(2) Identify and connect the electrical connectors of the cable (9) with the screws (4), (5) and (6).
(3) TORQUE the screws (4), (5) and (6):
- the screw (4)
to 0.11 m.daN (9.73 lbf.in)
- the screw (5)

MAINTENANCE APPLICATION OF CDCCL - AMM APPLICATION

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FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL (continued)

ESPM Application

Separation of fuel quantity and level indicating system wiring from other wiring.

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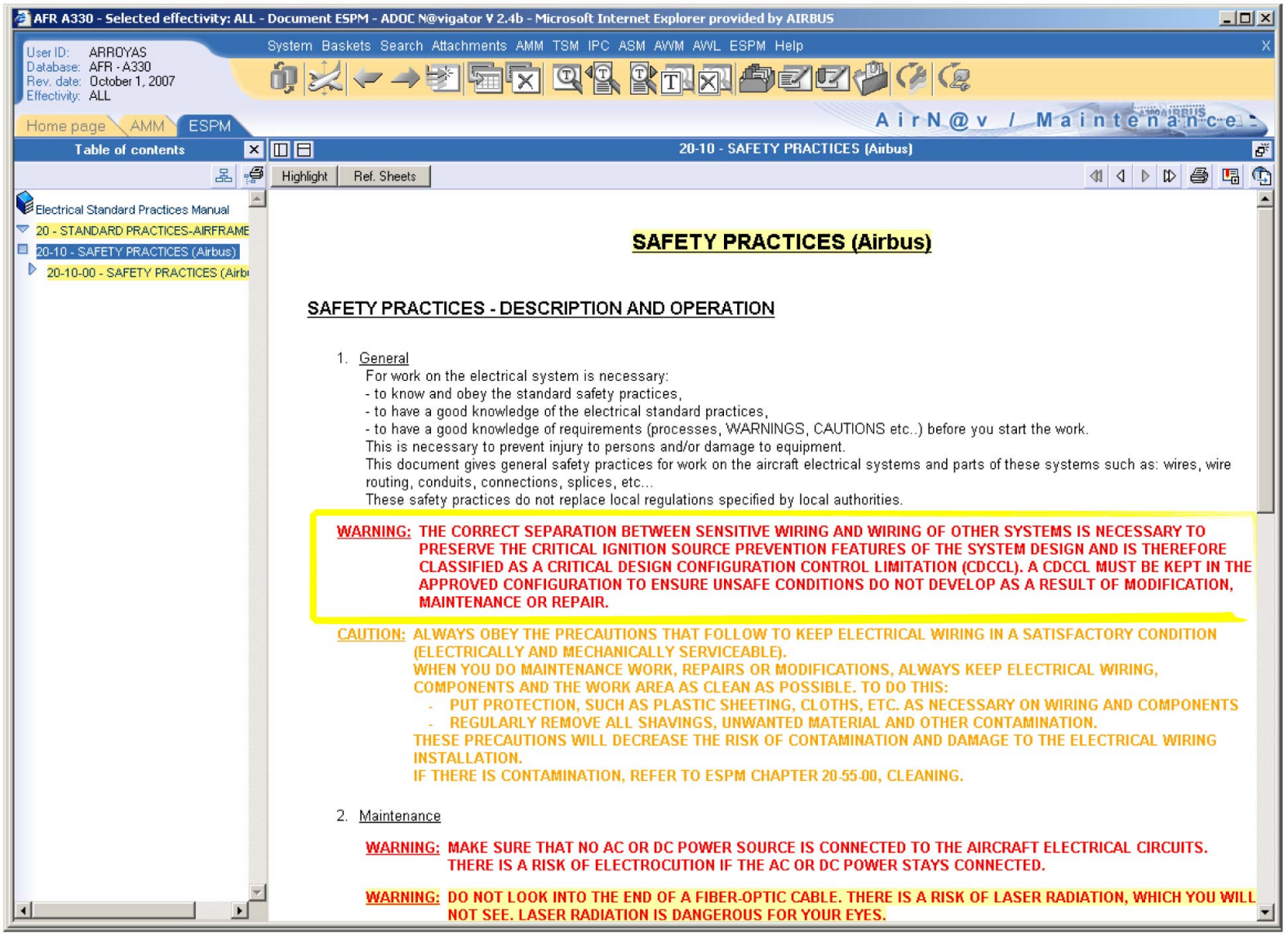
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Database: AFR - A330
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20-10 - SAFETY PRACTICES (Airbus)
20-10-00 - SAFETY PRACTICES (Airb
SAFETY PRACTICES (Airbus)
SAFETY PRACTICES - DESCRIPTION AND OPERATION
1. General
For work on the electrical system is necessary:
- to know and obey the standard safety practices,
- to have a good knowledge of the electrical standard practices,
- to have a good knowledge of requirements (processes, WARNINGS, CAUTIONS etc..) before you start the work.
This is necessary to prevent injury to persons and/or damage to equipment.
This document gives general safety practices for work on the aircraft electrical systems and parts of these systems such as: wires, wire routing, conduits, connections, splices, etc...
These safety practices do not replace local regulations specified by local authorities.
WARNING: THE CORRECT SEPARATION BETWEEN SENSITIVE WIRING AND WIRING OF OTHER SYSTEMS IS NECESSARY TO PRESERVE THE CRITICAL IGNITION SOURCE PREVENTION FEATURES OF THE SYSTEM DESIGN AND IS THEREFORE CLASSIFIED AS A CRITICAL DESIGN CONFIGURATION CONTROL LIMITATION (CDCCL). A CDCCL MUST BE KEPT IN THE APPROVED CONFIGURATION TO ENSURE UNSAFE CONDITIONS DO NOT DEVELOP AS A RESULT OF MODIFICATION, MAINTENANCE OR REPAIR.
CAUTION: ALWAYS OBEY THE PRECAUTIONS THAT FOLLOW TO KEEP ELECTRICAL WIRING IN A SATISFACTORY CONDITION (ELECTRICALLY AND MECHANICALLY SERVICEABLE).
WHEN YOU DO MAINTENANCE WORK, REPAIRS OR MODIFICATIONS, ALWAYS KEEP ELECTRICAL WIRING, COMPONENTS AND THE WORK AREA AS CLEAN AS POSSIBLE. TO DO THIS:
- PUT PROTECTION, SUCH AS PLASTIC SHEETING, CLOTHS, ETC. AS NECESSARY ON WIRING AND COMPONENTS
- REGULARLY REMOVE ALL SHAVINGS, UNWANTED MATERIAL AND OTHER CONTAMINATION.
THESE PRECAUTIONS WILL DECREASE THE RISK OF CONTAMINATION AND DAMAGE TO THE ELECTRICAL WIRING INSTALLATION.
IF THERE IS CONTAMINATION, REFER TO ESPM CHAPTER 20-55-00, CLEANING.
2. Maintenance
WARNING: MAKE SURE THAT NO AC OR DC POWER SOURCE IS CONNECTED TO THE AIRCRAFT ELECTRICAL CIRCUITS. THERE IS A RISK OF ELECTROCUTION IF THE AC OR DC POWER STAYS CONNECTED.
WARNING: DO NOT LOOK INTO THE END OF A FIBER-OPTIC CABLE. THERE IS A RISK OF LASER RADIATION, WHICH YOU WILL NOT SEE. LASER RADIATION IS DANGEROUS FOR YOUR EYES.

MAINTENANCE APPLICATION OF CDCCL - ESPM APPLICATION

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FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL (continued)

AMM Application

Direct bonding on items of an equipment inside a fuel tank.

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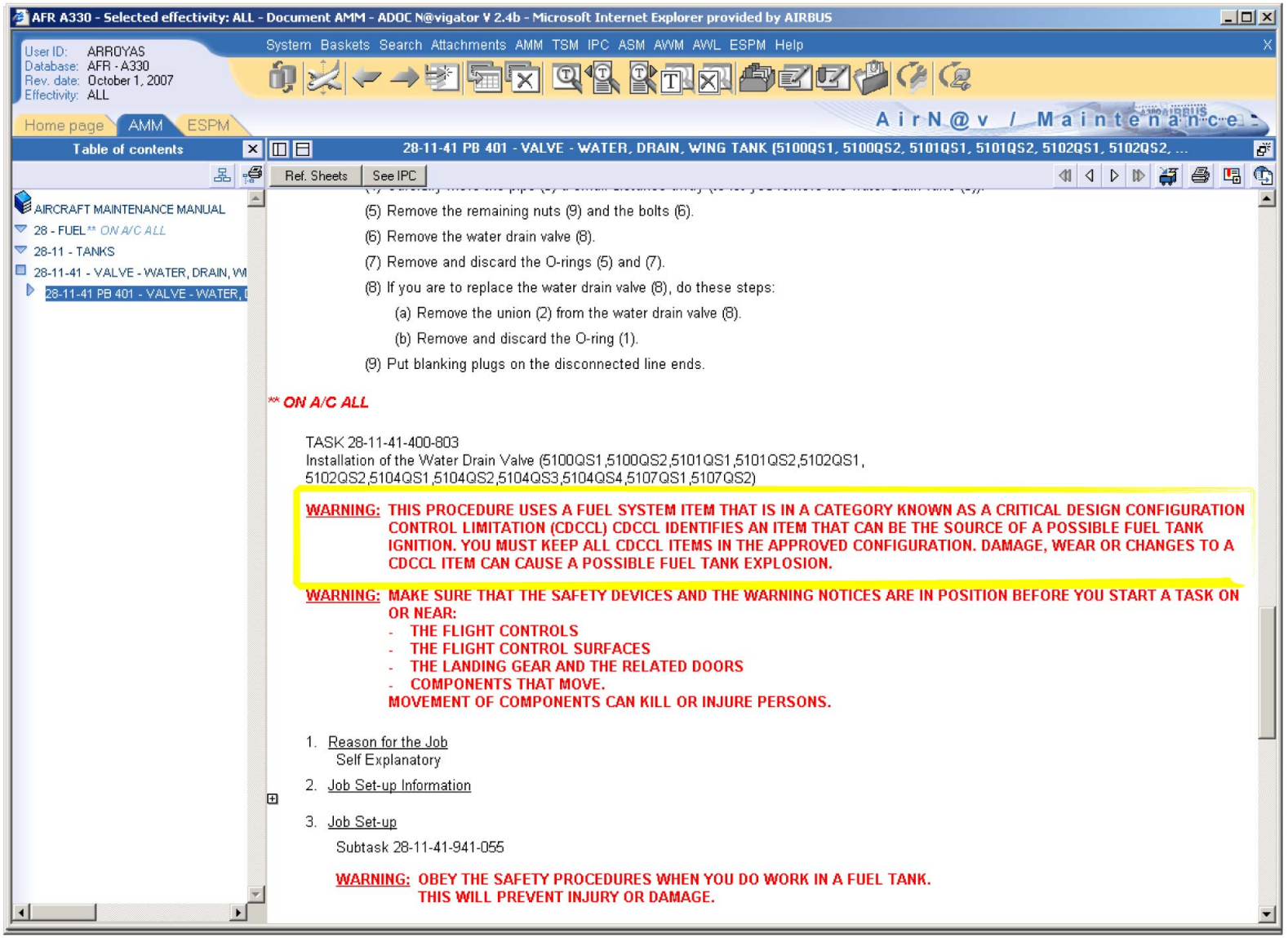
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28-11-41 PB 401 - VALVE - WATER, DRAIN, WING TANK (5100QS1, 5100QS2, 5101QS1, 5101QS2, 5102QS1, 5102QS2, ...
Ref. Sheets
See IPC
(5) Remove the remaining nuts (9) and the bolts (6).
(6) Remove the water drain valve (8).
(7) Remove and discard the O-rings (5) and (7).
(8) If you are to replace the water drain valve (8), do these steps:
(a) Remove the union (2) from the water drain valve (8).
(b) Remove and discard the O-ring (1).
(9) Put blanking plugs on the disconnected line ends.
** ON A/C ALL
TASK 28-11-41-400-803
Installation of the Water Drain Valve (5100QS1,5100QS2,5101QS1,5101QS2,5102QS1, 5102QS2,5104QS1,5104QS2,5104QS3,5104QS4,5107QS1,5107QS2)
WARNING: THIS PROCEDURE USES A FUEL SYSTEM ITEM THAT IS IN A CATEGORY KNOWN AS A CRITICAL DESIGN CONFIGURATION CONTROL LIMITATION (CDCCL) CDCCL IDENTIFIES AN ITEM THAT CAN BE THE SOURCE OF A POSSIBLE FUEL TANK IGNITION. YOU MUST KEEP ALL CDCCL ITEMS IN THE APPROVED CONFIGURATION. DAMAGE, WEAR OR CHANGES TO A CDCCL ITEM CAN CAUSE A POSSIBLE FUEL TANK EXPLOSION.
WARNING: MAKE SURE THAT THE SAFETY DEVICES AND THE WARNING NOTICES ARE IN POSITION BEFORE YOU START A TASK ON OR NEAR:
- THE FLIGHT CONTROLS
- THE FLIGHT CONTROL SURFACES
- THE LANDING GEAR AND THE RELATED DOORS
- COMPONENTS THAT MOVE.
MOVEMENT OF COMPONENTS CAN KILL OR INJURE PERSONS.
1. Reason for the Job
Self Explanatory
2. Job Set-up Information
3. Job Set-up
Subtask 28-11-41-941-055
WARNING: OBEY THE SAFETY PROCEDURES WHEN YOU DO WORK IN A FUEL TANK. THIS WILL PREVENT INJURY OR DAMAGE.

MAINTENANCE APPLICATION OF CDCCL - AMM APPLICATION

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FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL (continued)

CMM Application

Safety critical features of fuel pumps: these features must be maintained throughout the full life of the fuel pump to avoid a possible ignition source by overheating or sparks caused by arcing, or friction etc...

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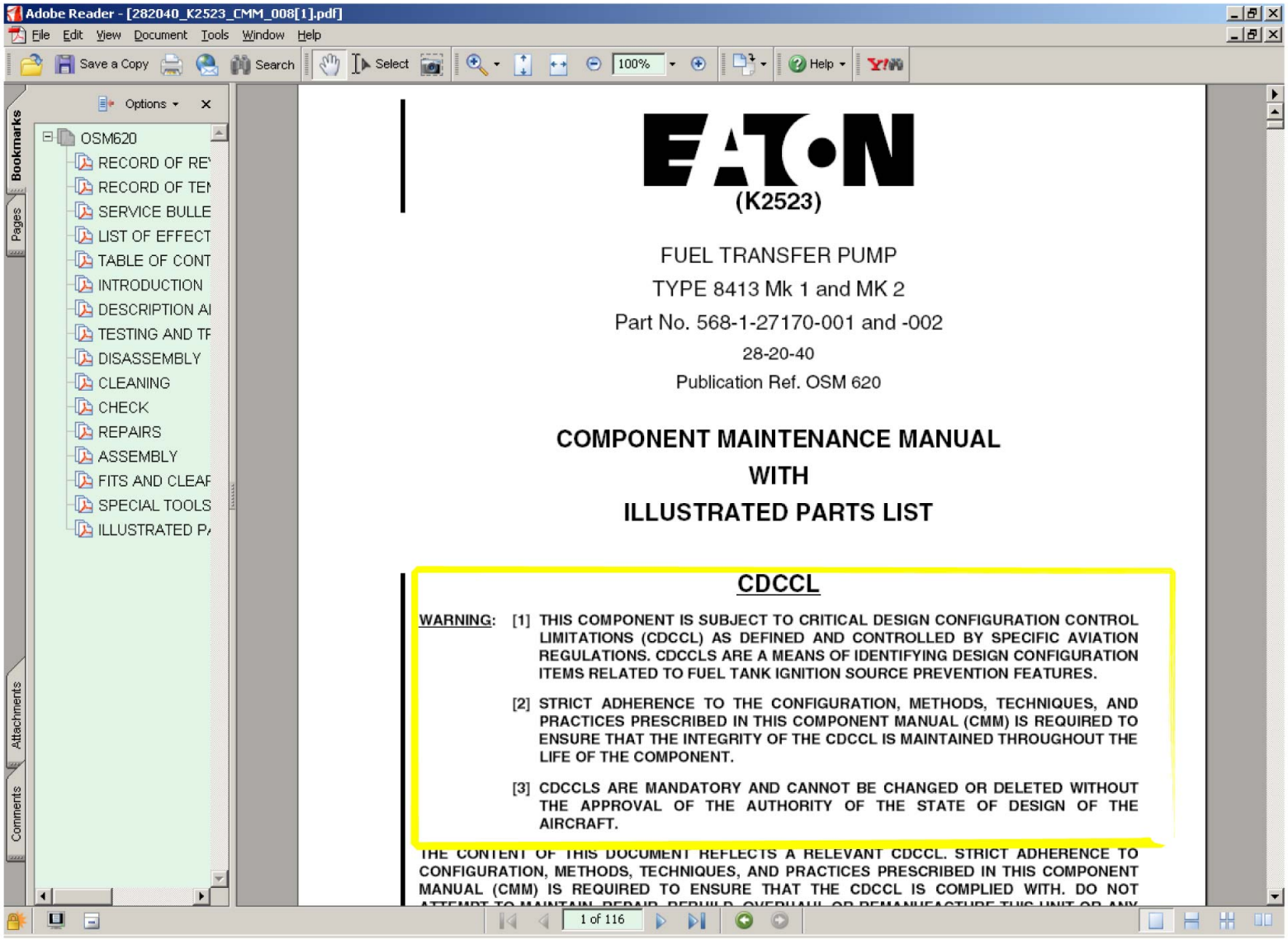
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(K2523)
FUEL TRANSFER PUMP
TYPE 8413 Mk 1 and MK 2
Part No. 568-1-27170-001 and -002
28-20-40
Publication Ref. OSM 620
COMPONENT MAINTENANCE MANUAL
WITH
ILLUSTRATED PARTS LIST
CDCCL
WARNING: [1] THIS COMPONENT IS SUBJECT TO CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL) AS DEFINED AND CONTROLLED BY SPECIFIC AVIATION REGULATIONS. CDCCLS ARE A MEANS OF IDENTIFYING DESIGN CONFIGURATION ITEMS RELATED TO FUEL TANK IGNITION SOURCE PREVENTION FEATURES.
[2] STRICT ADHERENCE TO THE CONFIGURATION, METHODS, TECHNIQUES, AND PRACTICES PRESCRIBED IN THIS COMPONENT MANUAL (CMM) IS REQUIRED TO ENSURE THAT THE INTEGRITY OF THE CDCCL IS MAINTAINED THROUGHOUT THE LIFE OF THE COMPONENT.
[3] CDCCLS ARE MANDATORY AND CANNOT BE CHANGED OR DELETED WITHOUT THE APPROVAL OF THE AUTHORITY OF THE STATE OF DESIGN OF THE AIRCRAFT.
THE CONTENT OF THIS DOCUMENT REFLECTS A RELEVANT CDCCL. STRICT ADHERENCE TO CONFIGURATION, METHODS, TECHNIQUES, AND PRACTICES PRESCRIBED IN THIS COMPONENT MANUAL (CMM) IS REQUIRED TO ENSURE THAT THE CDCCL IS COMPLIED WITH. DO NOT
1 of 116

MAINTENANCE APPLICATION OF CDCCL - CMM APPLICATION

G9409341 - GAUT0T0 - XM28D1000000001

FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL (continued)

MPD Application

Application in Maintenance Planning Document.

G9409341 - GAUT0T0 - XM28D1000000001

A380 MAINTENANCE PLANNING DOCUMENT

TASK NUMBER	ZONE	DESCRIPTION	THRESHOLD INTERVAL	SOURCE	REFERENCE	MEN	M/H	APPLICABILITY
281400-00003-01	198	PIPE SHROUD DRAINAGE AF OPC CHECK DRAIN MAST/LEAK MONITOR FOR BLOCKAGE/OPERATION.	I: 12 MO	MRB 9	281400-210-801 MRB REFERENCE 281400-00003-01M	1	0.10	A380-800
281400-00004-01	140 310	PIPE SHROUD DRAINAGE AF FNC PRESSURE CHECK TRIM TRANSFER PIPE SHROUD FOR INTEGRITY. ACCESS: 143AZ 197BB 198BB 311AB	I: 48 MO	MRB 8	281400-780-803 MRB REFERENCE 281400-00004-01M	1 1 * *	0.60 0.60 0.91 0.02	A380-800
281400-00005-01	140 310	PIPE SHROUD DRAINAGE AF FNC PRESSURE CHECK APU FUEL FEED PIPE SHROUD FOR INTEGRITY. ACCESS: 143AZ 197BB 198BB 313AB	I: 48 MO	MRB 8	281400-780-804 MRB REFERENCE 281400-00005-01M	1 1 * *	0.60 0.60 0.91 0.02	A380-800
281400-00006-01	198	PIPE SHROUD DRAINAGE AF OPC CHECK LEAK MONITOR FOR CORRECT OPERATION.	I: 7 DY	MRB 9	281400-710-802 MRB REFERENCE 281400-00006-01M	1	0.05	A380-800
281800-00001-01	140 300 500 600	IGNITION PREVENTION AF DET DETAILED INSPECTION OF WING AND TRIM TANK BONDING LEADS. ACCESS: 311AB	I: 144 MO	MRB 9	281800-220-801 MRB REFERENCE 281800-00001-01M	1 1 1 1 *	2.20 2.20 2.20 2.20 0.02	A380-800
281800-00002-01	500 600	IGNITION PREVENTION AF GVI GENERAL VISUAL INSPECTION OF COMPOSITE RIB BONDING STRAPS. ACCESS: 541AB 542DB 542EB 543AB 543BB 543CB 543DB 543EB 544AB 544BB 544CB 544DB * * * * * C O N T I N U E D * * * * *	I: 144 MO	MRB 9	281800-210-803 MRB REFERENCE 281800-00002-01M	1 1 *	0.90 0.90 3.54	A380-800

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MAINTENANCE APPLICATION OF CDCCL - MPD APPLICATION

G9409341 - GAUT0T0 - XM28D1000000001

FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL (continued)

SB Application

Service bulletin applicable on single aisle family aircraft.

G9409341 - GAUT0T0 - XM28D1000000001

A318/A319/A320/A321

SERVICE BULLETIN
REVISION TRANSMITTAL SHEET

AIRBUS
CUSTOMER SERVICES DIRECTORATE
1 Rond Point Maurice Bellonte
31707 BLAGNAC CEDEX FRANCE
Tel : (33) 5 61 93 33 33
Telex : AIRBU 530526F
Fax : (33) 5 61 93 42 51

ATA SYSTEM : 33

TITLE : LIGHTS - CARGO AND SERVICE COMPARTMENTS - INSTALL MAINTENANCE LIGHT F1000955-01

MODIFICATION No. : 33593K9935

This page transmits Revision No. 01 of Service Bulletin No. A320-33-1044.

ADDITIONAL WORK

No additional work is required by this revision for aircraft modified by any previous issue.

REASON

This Revision is issued to :

- update the operators,

- update the Weight and Balance Information of Kit D01 and D02.

CHANGES

SUMMARY :

- REASON/DESCRIPTION/OPERATIONAL CONSEQUENCES

. Kit price changed from 1470 to 1560 USD.

- EFFECTIVITY

. Operators updated.

PLANNING INFORMATION :

- EFFECTIVITY

. 1.A. Operators updated.

- WEIGHT AND BALANCE

. 1.H. Weight and Balance updated.

- REFERENCES

. 1.J. AMM reference 33-37-00 added.

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A318/A319/A320/A321

SERVICE BULLETIN
SUMMARY

AIRBUS
CUSTOMER SERVICES DIRECTORATE
1 Rond Point Maurice Bellonte
31707 BLAGNAC CEDEX FRANCE
Tel : (33) 5 61 93 33 33
Telex : AIRBU 530526F
Fax : (33) 5 61 93 42 51

This summary is for information only
and is not approved for modification of the aircraft

ATA SYSTEM : 33

TITLE : LIGHTS - CARGO AND SERVICE COMPARTMENTS - INSTALL MAINTENANCE LIGHT F1000955-01

MODIFICATION No. : 33593K9935

REASON/DESCRIPTION/OPERATIONAL CONSEQUENCES

The Special Federal Aviation Regulation (SFAR) 88 requests that the hydraulic area is protected against fuel vapour ignition. In order to fulfill the SFAR 88 requirements the maintenance lights 9LL and 10LL have been removed with Service Bulletin No. A320-92-1032.

This Service Bulletin details the procedure to replace maintenance lights 9LL and 10LL, PN 2LA002606-01, previously removed, with maintenance lights, PN F1000955-01.

The accomplishment of this Service Bulletin will fulfil the requirements of the SFAR 88 in maintenance areas.

EVALUATION TABLE			
COMPLIANCE	Recommended	CANCELS INSPECTION SB	No
POTENTIAL AD	No	A/C OPERATION AFFECTED	No
RELIABILITY AFFECTED	No	PAX COMFORT AFFECTED	No
COST SAVING	No	ETOPS AFFECTED	No
STRUCTURAL LIFE EXTN	No	VENDOR SB INVOLVED	No
KIT PRICE (USD)D01	1560	KIT PRICE (USD)D02	1560

EFFECTIVITY

This Service Bulletin is applicable to this (these) operator(s) :

30X 31X 53Z 57Y 72Y 83Y 88Y A1L AAF AAR ABQ ABY ACA ACI ADR AFL AFR AHY AJM ALK AMC AMU ANA ANZ ARF AUA AWE AZA BAW BES BGH BIE BMA BWG CBF CCM CES CIB CJG CNW CRX CSA CSC CSN CTN CXN CYP D2F DAT DCS DGA DKN DLH EDW EEZ EGN EIN EIR EZY F2I F2L FCA FFT FHY FIN G2X G4I G8E GBL GFA GWI GWY HDA HEJ HVN I2L IAC IBE IRM ISS IWD JBU JCS JET JKK JST KAC KYV LAJ LAN LAO LBT LTC LTE LTU LVG LXR MAU MEA MHS

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MAINTENANCE APPLICATION OF CDCCL - SB APPLICATION

FUEL TANK SAFETY PROCEDURES (2)

Maintenance Application of CDCCL (continued)

AD Application

Extract of the Airworthiness Directive.

G9409341 - GAUT0T0 - XM28D1000000001

FAA
Aircraft Certification Service

AIRWORTHINESS DIRECTIVE

www.faa.gov/aircraft/safety/alerts/
www.gpoaccess.gov/fr/advanced.html

2007-15-06 Airbus: Amendment 39-15135. Docket No. FAA-2007-27268; Directorate Identifier 2006-NM-190-AD.

Effective Date

(a) This AD becomes effective August 28, 2007.

Affected ADs

(b) None.

...

Revise ALS To Incorporate CDCCLs

(g) Within 12 months after the effective date of this AD, revise the ALS of the Instructions for Continued Airworthiness to incorporate Airbus A318/A319/A320/A321 ALS Part 5–Fuel Airworthiness Limitations, dated February 28, 2006, as defined in Airbus A318/A319/A320/A321 Fuel Airworthiness Limitations, Document 95A.1931/05, Issue 1, dated December 19, 2005 (approved by the EASA on March 14, 2006), Section 2, "Critical Design Configuration Control Limitations."

No Alternative Inspections, Inspection Intervals, or CDCCLs

(h) Except as provided by paragraph (i) of this AD: After accomplishing the actions specified in paragraphs (f) and (g) of this AD, no alternative inspections, inspection intervals, or CDCCLs may be used.

...

MAINTENANCE APPLICATION OF CDCCL - AD APPLICATION

G9409341 - GAUT0T0 - XM28D1000000001

FUEL TANK SAFETY PROCEDURES (2)

Safety Precautions

Make sure that you have the correct fire fighting equipment available.
When you have to work on a fuel system wiring, you must use test equipment that is approved (otherwise, unapproved equipment could cause fire or an explosion).
Make sure that the lighting in the work area is sufficient to work safely.
Wear protective goggles or face mask, clothes and gloves and avoid wearing metallic clothing (e.g. footwear or a belt with a metal buckle) which can cause sparks.
In the work area you must not:
- smoke,
- use flames which do not have protection,
- operate electrical equipment which is not necessary for the task,
- pull or move metal objects along the ground,
- use hearing-aids or battery-operated equipment which will cause sparks.

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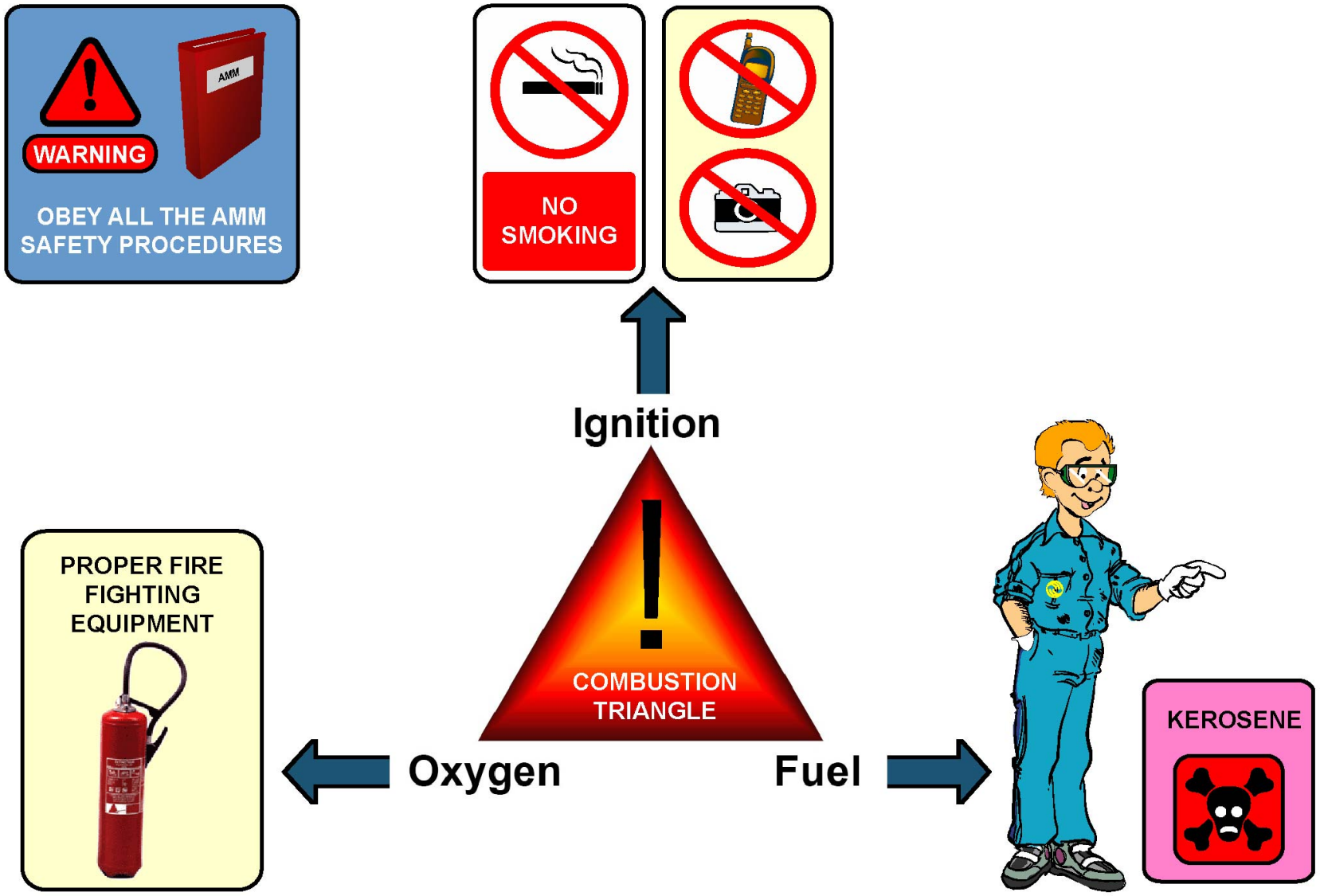


SAFETY PRECAUTIONS

G9409341 - GAUT0T0 - XM28D1000000001

FUEL TANK SAFETY PROCEDURES (2)

Safety Areas And Accessibility

Put the safety barriers in position and put the warning notices, to tell persons not to operate the fuel system, not to refuel the aircraft and not to operate the flaps.
Defuel the applicable wing tank or do a ground fuel transfer. Use the ECAM to make sure that the applicable fuel tank valves are closed and drain the remaining fuel
Open and safety tag circuit breakers for refuel system, refuel panel, applicable fuel valves and SFCC (Slat Flap Control Computers).
Open the related fuel tanks access panels.

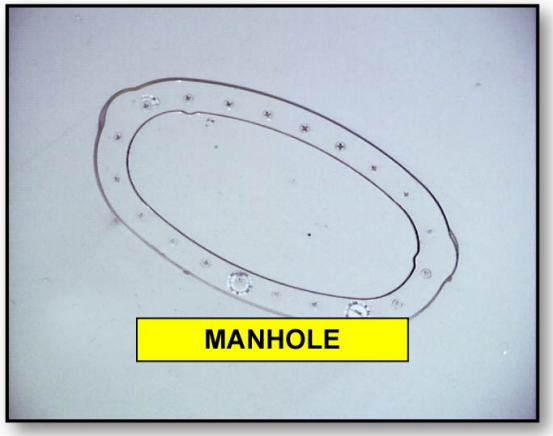
NOTE: Note: Some of these precautions are the minimum safety standard for work in a fuel tank. Local regulations can make other safety precautions necessary.

Safety barriers & warning notices must be in position prior to starting a task.

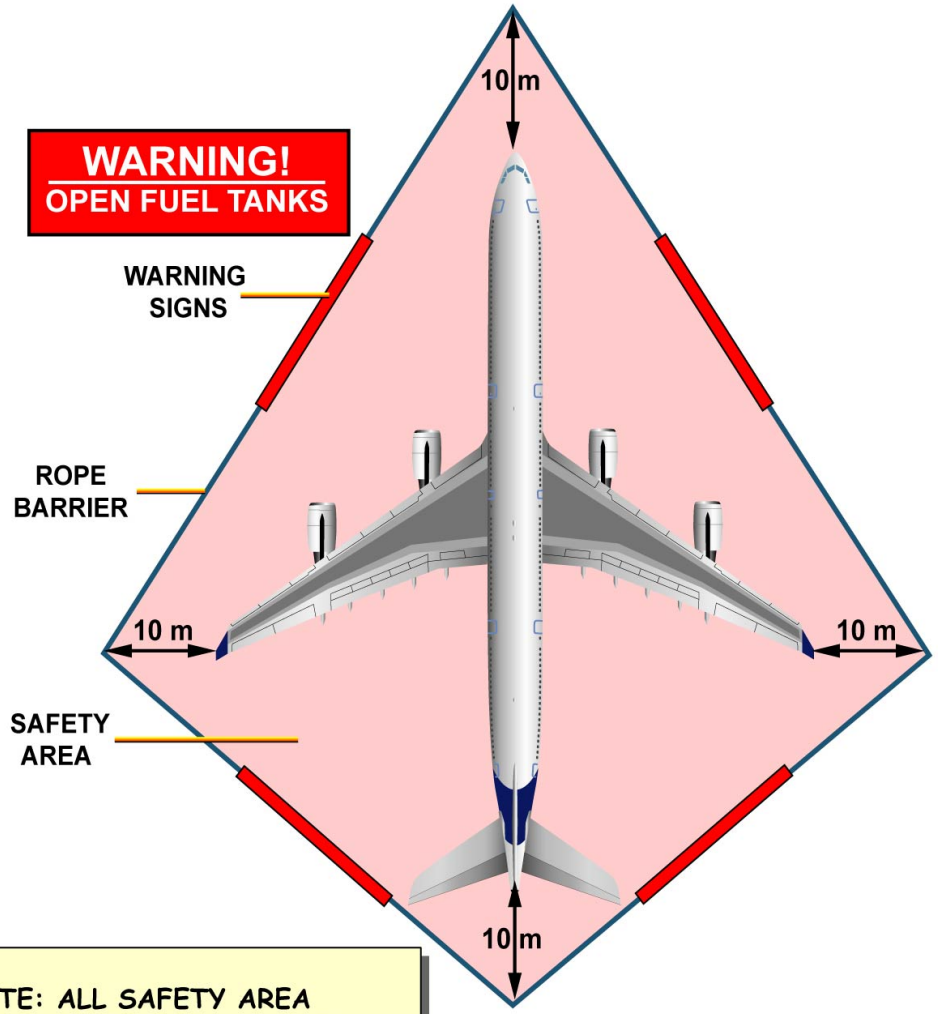
Do not operate the fuel system or the F/CTL (Slats & Flaps) or the L/G system : Movement of surrounding components can kill or injure people.

Defuel and drain the applicable wing tank.

Then open the fuel tank access panels :



EXAMPLE OF AN UNDER-WING FUEL TANK ACCESS PANEL (MANHOLE)



NOTE: ALL SAFETY AREA CLEARANCES ARE SUBJECT TO CHANGE ACCORDING TO LOCAL AIRPORT REGULATIONS.

SAFETY AREAS AND ACCESSIBILITY

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FUEL TANK SAFETY PROCEDURES (2)

Tanks Ventilation

Vent the tanks with a proper venting system (fitted with minimum 1 air inlet & 1 air outlet).
Check with a combustible gas indicator (after minimum 6 hours of ventilation) the tanks fuel gas concentration.
The fuel gas concentration must be < 10% of the Lower Explosive Limit (LEL) before entering into the tanks.

WARNING: You must use a respirator if the fuel-gas concentration in the fuel tanks is more than 5% of the Lower Explosive Limit (LEL).

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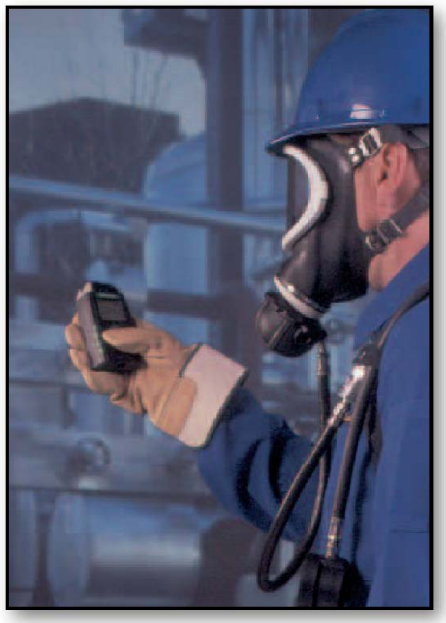
VENTING SYSTEM

Vent the tanks with a proper venting system (fitted with minimum 1 air inlet & 1 air outlet)

WARNING

KEEP THE VENTILATION AVAILABLE DURING THE COMPLETE WORK PROGRESS IN THE TANKS.



COMBUSTIBLE GAS INDICATOR

Check with a combustible gas indicator (after minimum 6 hours of ventilation) the tanks fuel gas concentration.

Fuel gas concentration must be < 10% of the Lower Explosive Limit (LEL) before entering into the tanks.

TANKS VENTILATION

FUEL TANK SAFETY PROCEDURES (2)

Entry Check-List

You must complete the Pre-Entry Checklist before you do work in a fuel tank.
Finally, get access to the applicable work area.

WARNING: S:
- do not touch or push against the magnetic level indicators when you are in the fuel tank. This will prevent damage to them.
- do not touch or push against the FQI probes when you are in the fuel tank. This will prevent damage to them and their installation.
- do not cause damage to the internal structure, sealant, electrical cables, or conduits during maintenance.

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Following the AMM Fuel Safety Procedures, maintenance personnel must fill in this PRE-ENTRY CHECK LIST before entering and working in the fuel tank.

WARNING

WHEN ENTERING A FUEL TANK THROUGH A MANHOLE ACCESS PANEL, YOU MUST NOT HOLD ON SURROUNDING ELECTRICAL COMPONENTS LOCATED INSIDE THE TANKS.

EXTRACT OF AN A330 AMM FUEL TANK ENTRY CHECKLIST

This check list must be complete before you do work in the fuel tank.

Wet Fuel Tank Entry Location

Aircraft:_____ Tank:_____ Shift:_____ Date:_____

Shift Supervisor is:_____

✓ the box when you have made sure that :-

- ☐ 1. All the aircraft electrical circuits are de-energized.
- ☐ 2. The aircraft is electrically grounded.
- ☐ 3. All the access platforms and associated equipment are electrically grounded.
- ☐ 4. All the electrical ground power units are disconnected.
- ☐ 5. Access to the area is limited and warning signs are in position.
- ☐ 6. A checklist of all tools and equipment to be used in the fuel tank is available.
- ☐ 7. Only approved spark-proof lamps and torches are in the work area. Sealed vapor-lamps are not to be used.
- ☐ 8. Only approved protective clothing is used.
- ☐ 9. The tank entry person and the safety person each have two air-supplied respirators that operate satisfactorily.
- ☐ 10. Both the tank entry person and the safety person have current medical certificates for entry into tanks.
- ☐ 11. Lint free cloths and special fire-proof containers are available to remove all remaining fuel.
- ☐ 12. There is a continuous flow of clean filtered air through the fuel tank available when the person is in the tank.
- ☐ 13. The vapor concentration is less than 25% of the applicable Lower Explosion Limit (LEL).
- ☐ 14. Correct fire fighting equipment and approved persons available.
- ☐ 15. The fire department has been told.

Meter Reading

- ☐ 16. Fuel-Gas concentration (LEL) reading prior to tank entry is:_____

I confirm that all entry requirements were met before entry was made into the tanks.

Signature of Supervisor Date/Time

Pre-Entry Checklist into a Wet Fuel Tank

ENTRY CHECK-LIST

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FUEL TANK SAFETY PROCEDURES (2)

Working Environment

NOTE: Note: You may have to remove parts of the structure (and equipment) to get access to parts of the tank.
Use protective mats on the floor of the fuel tank to prevent:
- damage to the fuel tank structure,
- injury to persons,
- safety all components before you place them inside the fuel tank,
- all wire locking must be installed/adjusted outside the fuel tank.

Use only RED tie wraps in the fuel tanks.
Use only approved cleaning materials.
Make sure that all signs of solvents and cleaning agents are removed from the equipment/components before they are installed.
Put blanking caps on all disconnected pipes and openings in components and tanks.
Do not connect electrical equipment to a power source less than 30 meters away, unless the power source has spark-proof connectors.
You must obey the fuel safety procedures when you do work in a fuel tank. When differences occur, you must use the approved precautions of this procedure.

WARNING: Do not use metallic wire wool in fuel tanks.

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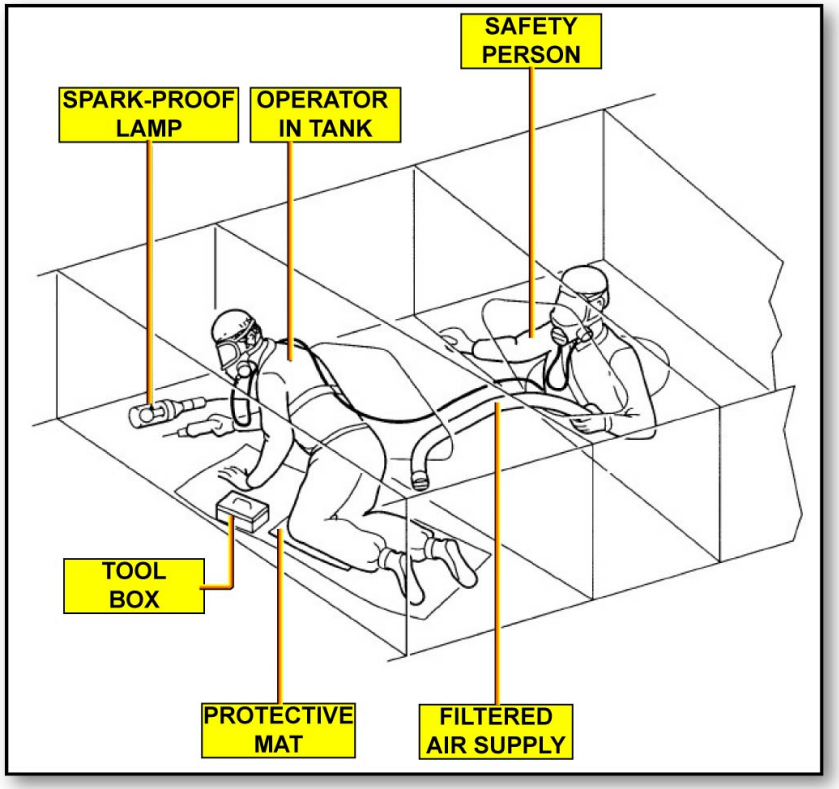
WARNING

OBEY THE SAFETY PROCEDURE WHEN YOU DO WORK IN A FUEL TANK. THIS WILL PREVENT INJURY OR DAMAGE.



Maintenance personnel working in fuel tanks must :
- work in team (safety person required)
- use proper lighting(e.g. spark proof lamp)
- use proper filtered air supply
- use protective mats on the floor to prevent damage to people and structure
- make sure that all the fuel system components have correct electrical bonding.
- record the removed parts and record the position of each panel bolt. This will prevent damage to the structure.

WORKING ENVIRONMENT

FUEL TANK SAFETY PROCEDURES (2)

Close-Up

After completion of a work in a fuel tank, personnel must make sure that:
- the work area is clear of tools,
- the work area is clean,
- no electrical equipment has been damaged and disconnected,
- all the fuel system components have a correct electrical bonding,
- all access panels are back in their original position (e.g. rib access panels).

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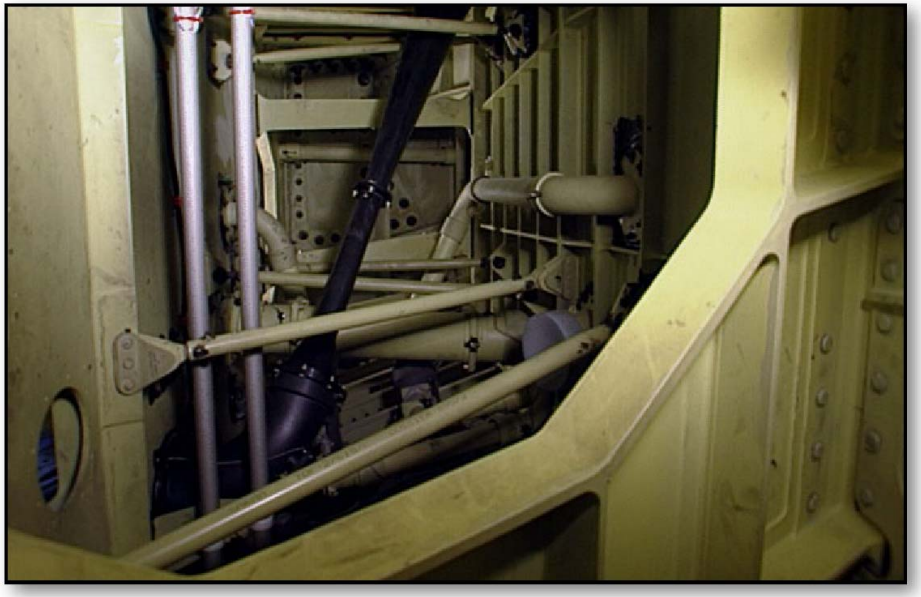
After completion of a work in a fuel tank, personnel must make sure that :
- the work area is clear of tools
- the work area is clean
- no electrical equipment has been damaged and disconnected
- all the fuel system components have a correct electrical bonding.
- all access panels are back in their original position (e.g. rib access panels)



EXAMPLE OF AN AIRBUS A330/A340 WING FUEL TANK (COLLECTOR CELL)

CLOSE-UP

FUEL SYSTEM BASE MAINTENANCE (3)

GENERAL REFUEL/DEFUEL SAFETY PROCEDURES

WARNING: ALWAYS CONNECT THE GROUND CABLE TO THE PARKING GROUND POINT BEFORE YOU CONNECT IT TO THE A/C. DO NOT ATTACH THE CABLE TO THE A/C FIRST (THERE IS A RISK OF ELECTRIC SHOCK).

Make sure that all fuel system electrical circuits are complete. Do not spill fuel on the engines or brakes. Ground and bond the A/C.
Make sure that the refuel safety area is clear and respect the safety distances:
- 60 meters: stop and do not operate fuel tanker 60 m from the A/C nose during weather radar operation,
- 30 meters: do not refuel within 30 m while testing radar or HF radio equipment.

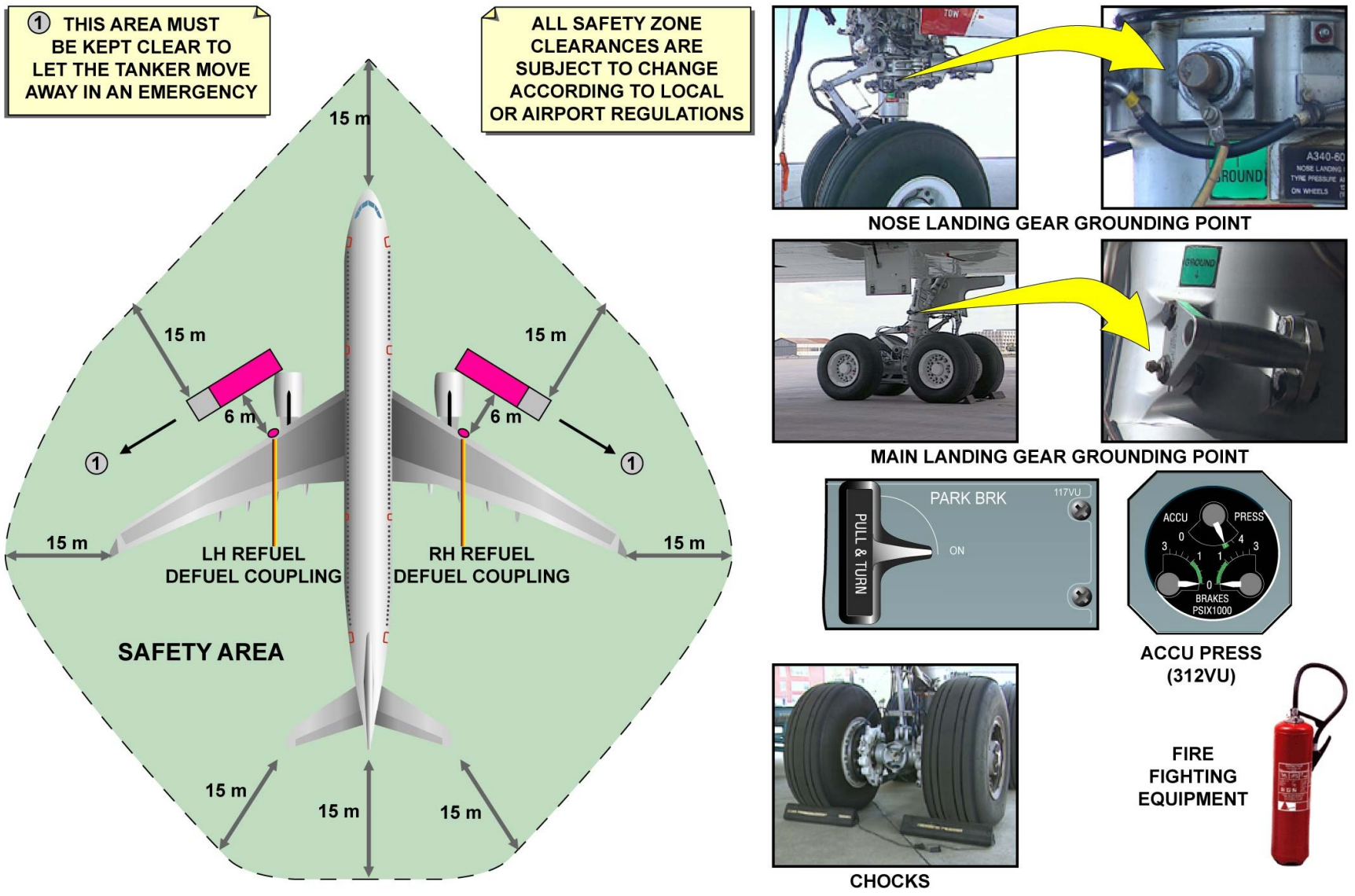
15 meters:
- NO SMOKING notices should be placed at least 15 m around the refuel/defuel area,
- no electrical equipment within 15 m, refuel/defuel equipment,
- fuel tank vents should not be within 15 m of any building.

6 meters:
- Ground Power Units (GPUs) must be at least 6 m from the A/C fueling and venting points,
- flash bulbs/flash equipment must not be used within 6 m of the A/C fueling and venting points,
- the refuel/defuel safety zone extends at least 6 m from the A/C fueling and venting points,
- inside the 6 m safety zone - no matches, radios, cell phones, mobile phones, pagers, etc.

Check the PARKing BRake is ON and check the blue accumulator pressure.
The increased weight of the fuel may cause chocks to get stuck under the tires:
- move the aft NLG chocks away from the tires,
- reposition the MLG chocks away from the tires.

Make sure that there is fire-fighting equipment/personnel available and do not run engines during refuel/defuel procedures. APU starts or shutdowns are permitted during refuel/defuel procedures, but:
- starting is not permitted if the APU has failed to start or an automatic shutdown has occurred,
- a normal APU shutdown must be completed if a fuel spill has occurred.

Make sure that any electrical equipment used will not cause sparks. Do not refuel/defuel in bad weather conditions, lightning can be dangerous.
During the refuel/defuel procedure:
- do not operate A/C external lighting,
- do not fill the oxygen system,
- do not use the microphone for HF transmissions,
- do only essential maintenance and servicing that will not cause sparks.



GENERAL REFUEL/DEFUEL SAFETY PROCEDURES

G9409341 - GAUT0T0 - FM28Y2BASEMCE03

FUEL SYSTEM BASE MAINTENANCE (3)

BLEEDING OF THE APU FUEL LINE

This topic describes the bleeding of the APU fuel line.
Put the warning notices in position:
- on the FUEL panel, to tell people not to operate the fuel system,
- on the refuel/defuel panel, to tell people not to refuel the A/C.

Install the mechanical input/rigging in the mechanical input of the THS actuator.
Open the APU access doors and safety them in the open position.
Put a 10 l container in position below the vent and drain valve.
To bleed the APU fuel line:
- remove the cap from the vent and drain valve,
- install the ADAPTER - VENT AND DRAIN VALVE, APU on the vent and drain valve,
- on the firewall, inside of the APU compartment (FR94), push the FUEL VENT line P/BSW,
- when the fuel flows out of the drain hose without air, release the FUEL VENT line P/BSW,
- remove the ADAPTER - VENT AND DRAIN VALVE, APU from the vent and drain valve,
- install the cap at the vent and drain valve and tighten it with your hand.

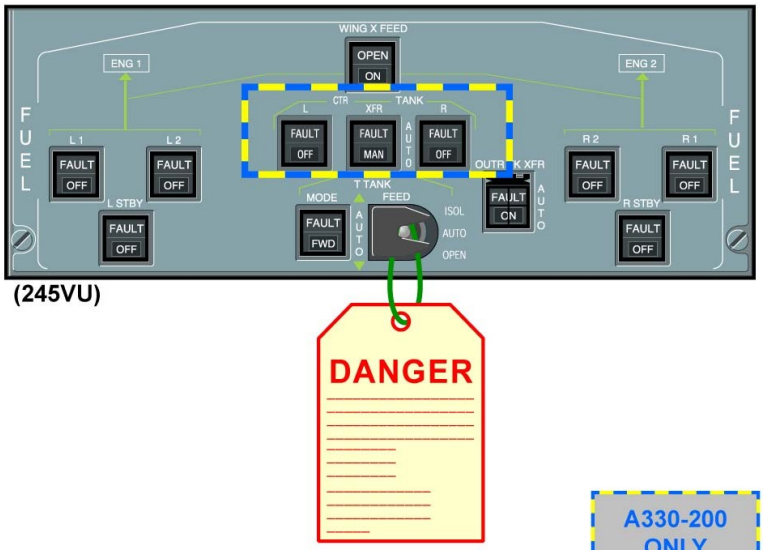
Remove all the fixtures, tools, test and support equipment used during this procedure. The task is now completed.

G9409341 - GAUT0T0 - FM28Y2BASEMCE03

Bleeding of the APU fuel line
...
Job set-up
...
Put the warning notices and the RIGGING PIN of the THS actuator
Get Access
...
Procedure
...
Bleeding of the APU fuel line
...
Close-up
...

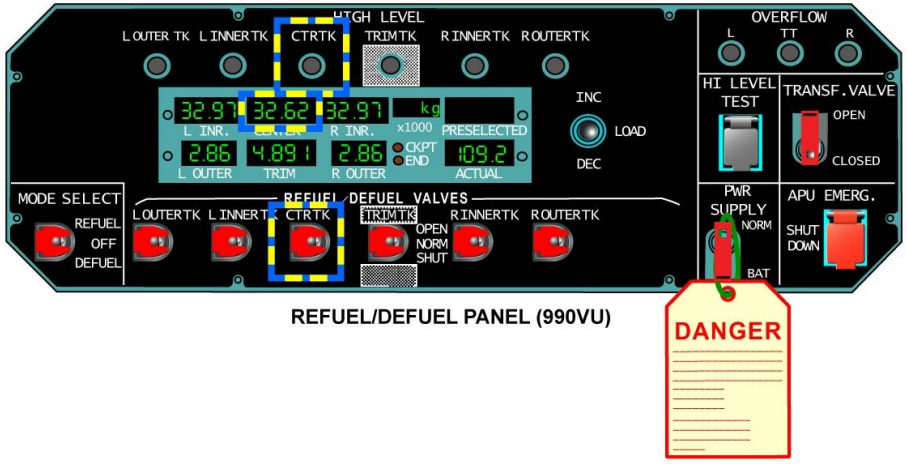
BLEEDING OF THE APU FUEL LINE

Bleeding of the APU fuel line
...
Job set-up
...
Put the warning notices:
✓ - on the panel 245VU, to tell people not to operate the fuel system,
✓ - on the panel 990VU, to tell people not to refuel the aircraft.
...
Install the MECHANICAL INPUT - RIGGING PIN in the mechanical input of the THS actuator.
...
Get Access
...
Procedure
...
Bleeding of the APU fuel line
...
Close-up
...

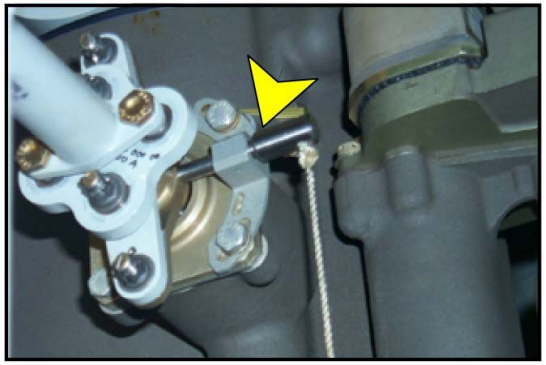


(245VU)

A330-200 ONLY



REFUEL/DEFUEL PANEL (990VU)



RIGGING PIN (0U191067) IN THE MECHANICAL INPUT OF THE THS ACTUATOR

BLEEDING OF THE APU FUEL LINE

Bleeding of the APU fuel line

...

Job set-up

...

✓ **Put the warning notices and the RIGGING PIN of the THS actuator**

⇨ **Get Access**

✓ Open the access doors 315AL and 316AR and safety them in open position.

...

⇨ Put a 10 l container in position below the vent and drain valve.

...

...

Procedure

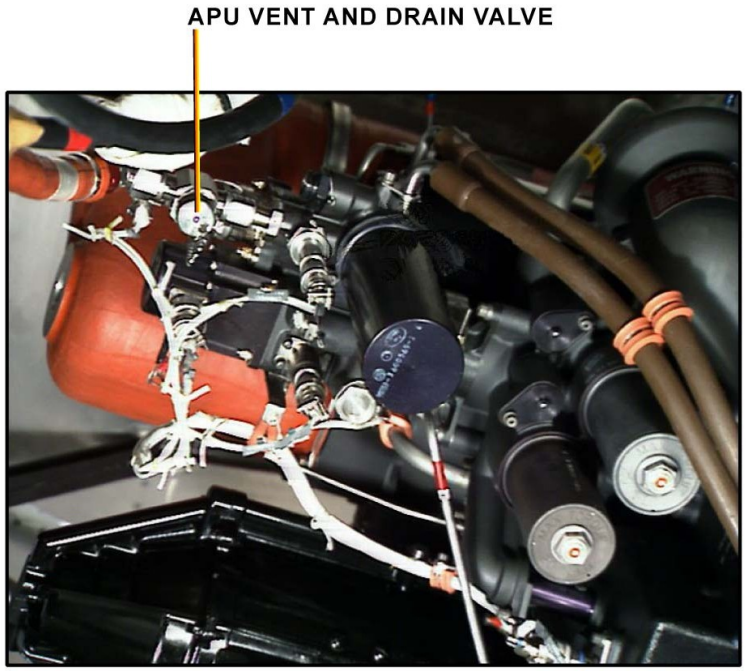
...

Bleeding of the APU fuel line

...

Close-up

...



BLEEDING OF THE APU FUEL LINE

G9409341 - GAUT0T0 - FM28Y2BASEMCE03

Bleeding of the APU fuel line

...

✓ **Job set-up**

...

✓ **Put the warning notices and the RIGGING PIN of the THS actuator**

✓ **Get Access**

...

Procedure

...

⇨ **Bleeding of the APU fuel line**

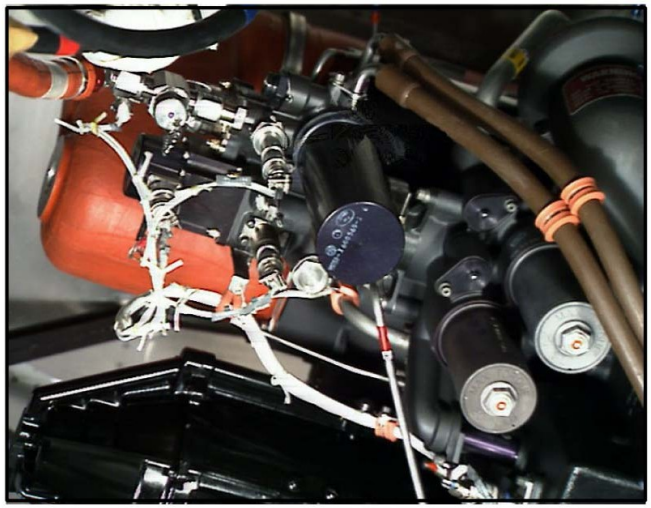
- ✓ Remove the cap from the vent and drain valve.
- ✓ Install the ADAPTER - VENT AND DRAIN VALVE, APU on the vent and drain valve.
- ✓ On the firewall, inside of the APU compartment (FR94), push the FUEL VENT line P/BSW.
- ✓ When the fuel flows out of the drain hose without air, release the FUEL VENT line P/BSW.
- ✓ Remove the ADAPTER - VENT AND DRAIN VALVE, APU from the vent and drain valve.
- ⇨ Install the cap at the vent and drain valve and tighten it with your hand.

...

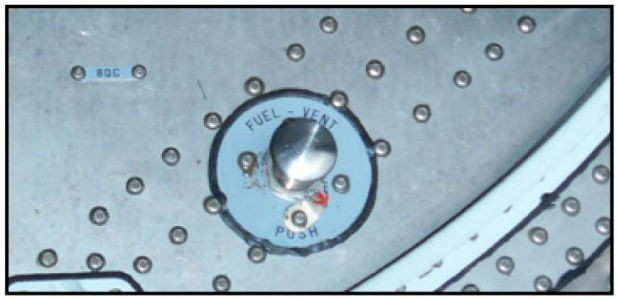
...

Close-up

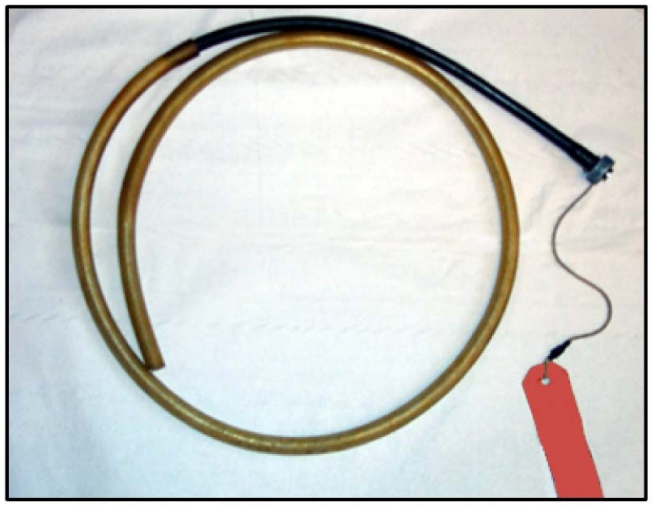
...



APU VENT AND DRAIN VALVE



FUEL VENT line P/BSW



ADAPTER - VENT AND DRAIN VALVE, APU (98A28007570000)

BLEEDING OF THE APU FUEL LINE

G9409341 - GAUT0T0 - FM28Y2BASEMCE03

Bleeding of the APU fuel line
...
✓ Job set-up
...
✓ Put the warning notices and the RIGGING PIN of the THS actuator
✓ Get Access
...
✓ Procedure
...
✓ Bleeding of the APU fuel line
...
✓ Close-up
...

TASK COMPLETED

BLEEDING OF THE APU FUEL LINE

AIRBUS

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